ROADS

A8 Belfast to Larne Dual Carriageway (Coleman's Corner to Ballyrickard Road)

Environmental Statement Volume I

January 2011

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Roads Service

A8 Belfast to Larne Dual Carriageway (Coleman's Corner to Ballyrickard Road)

Environmental Statement

124785/ES/I1

Issue | January 2011

Ove Arup & Partners Ltd
The Linenhall
8th Floor
32-38 Linenhall Street
Belfast
BT2 8BG
Northern Ireland
www.arup.com

Job number 124785

ARUP

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List of Abbreviations

AADT	Annual Average Daily Traffic
ADAS	ADAS Consultants
ADS	Advance Directional Sign
AIA	Agricultural Impact Assessment
AONB	Area of Outstanding Natural Beauty
AQMA	Air Quality Management Area
ASSI	Area of Special Scientific Interest
BAP	Biodiversity Action Plan
BCR	Benefits to Cost Ratio
Bgl	Below ground level
BGS	British Geological Survey
BH	Borehole
BMTP	Belfast Metropolitan Transport Plan
BNL	Basic Noise Level
BPM	Best Practicable Means
BT	British Telecom
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
BTO	British Trust for Ornithology
CBR	California Bearing Ratio
CEDaR	Centre for Environmental Data and Recording
CO	Carbon Monoxide
CoC	Contaminants of Concern
CoCP	Code of Construction Practice
CRF	Congestion Reference Flow
cSAC	Candidate Special Area of Conservation
D&B	Design and Build
DARD	Department for Agriculture and Regional Development
DCAL	Department for Culture Arts and Leisure
DCAN	Development Control Advice Note
DHP	Defence Heritage Project

DMRB	Design Manual for Roads and Bridges
dNAP	Draft Northern Area Plan
DOE	Department of the Environment
DRD	Department for Regional Development
D2RAP	Dual Two Lane Rural All Purpose
D&B	Design and Build
EA	Environment Agency (UK)
EC	European Council
ECom	European Commission
EIA	Environmental Impact Assessment
ELG	Environmental Liaison Group
EPA	Environmental Protection Agency
EPUK	Environmental Protection United Kingdom
EQS	Environmental Quality Standard
ES	Environmental Statement
ESCR	Earth Science Conservation Review
EU	European Union
FEH	Flood Estimation Handbook
FFD	Freshwater Fish Directive
FRA	Flood Risk Assessment
FSR	Flood Studies Report
GAC	Generic Assessment Criteria
GI	Ground Investigations
GLA	Greater London Authority
GLVIA	Guidelines for Landscape and Visual Impact Assessment
GQA	General Quality Assessment
GSNI	Geological Survey Northern Ireland
GSJ	Grade Separated Junction
Ha	Hectare
HAWRAT	Highways Agency Water Resources Assessment Tool
HEC RAS	Hydrologic Engineering Centre River Analysis System
HDV	Heavy Duty Vehicle

HGV	Heavy Goods Vehicle
HPZ	Hydrological Protection Zone
IDP	Investment Delivery Plan for Roads
IDT	Integrated Delivery Team
IoA	Institute of Acoustics
IEEM	Institute of Ecology and Environmental Management
IHR	Industrial Heritage Record
IRBD	International River Basin District
IRDB	International River Drainage Basin
ISNI	Investment Strategy for Northern Ireland
JNCC	Joint Nature Conservation Committee
Km	Kilometre
KTC	Key Transport Corridor
LDS	Local Directional Sign
LCA	Landscape Character Area
LPPA	Local Landscape Policy Area
LQM	Land Quality Management
LVIA	Landscape and Visual Impact Assessment
MGI	Main Ground Investigations
NAQS	National Air Quality Strategy
NETCEN	National Environmental Technology Centre
NH_3	Chemical formula for Ammonia
NI	Northern Ireland
NIBS	Northern Ireland Biodiversity Strategy
NIE	Northern Ireland Electricity
NIEA	Northern Ireland Environment Agency
NILCA	Northern Ireland Landscape Character Assessment
NIBG	Northern Ireland Biodiversity Group
NISMR	Northern Ireland Sites and Monuments Record
NIW	Northern Ireland Water
NMU	Non Motorised Users
NOx	Nitrogen Oxides

NO_2	Nitrogen Dioxide
NPV	Net Present Value
NTS	Non Technical Summary
NVC	National Vegetation Classification
OS	Ordnance Survey
OSNI	Ordnance Survey Northern Ireland
PAH	Polycyclic Aromatic Hydrocarbons
PGR	Preliminary Geotechnical Report
PM	Particulate Matter
PPG	Pollution Prevention Guidelines
PPS	Planning Policy Statement
PRONI	Public Records Office of Northern Ireland
PSD	Particle Size Distribution
pSPA	Potential Special Protection Area
PSSR	Preliminary Sources Study Report
Qmed	Median Annual Maximum Flow
Q_{95}	95^{th} Percentile Flow
RDS	Regional Development Strategy
RIGS	Regionally Important Geological / Geomorphological Sites
RSPB	Royal Society for the Protection of Birds
RST	Runoff Specific Threshold
RSTN TP	Regional Strategic Transport Network Transport Plan
RTC	Road Traffic Collision
RTS	Regional Transport Strategy
SAC	Special Area of Conservation
SEA	Strategic Environmental Assessment
SDS	Sustainable Development Strategy
SLNCI	Site of Local Nature Conservation Importance
SGV	Soil Guide Values
SHM	Scheduled Historic Monument
SMA	Stone Mastic Asphalt
SML	Soil Mechanics Limited

SPA	Special Protection Area
SPR	Source Protection Zone
SPTS	Standard Penetration Tests
SPZ	Source Protection Zone
SRI	Strategic Road Improvements
SRTP	Sub Regional Transport Plan
SUDS	Sustainable Drainage Systems
SVOC	Semi-volatile Organic Compounds
TOX	Toxicology
TPH	Total Petroleum Hydrocarbons
TPO	Tree Preservation Order
TUBA	Transport User Benefits Appraisal
UK	United Kingdom
UKBAP	United Kingdom Biodiversity Action Plan
UKDWS	United Kingdom Drinking Water Standards
UKTAG	United Kingdom Technical Advisory Group
UWWTD	Urban Wastewater Treatment Directive
VEM	Visual Envelope Map
VID	Visual Intrusion Drawing
VIS	Visual Intrusion Schedule
VKT	Vehicle Kilometers Travelled
VOC	Volatile Organic Compounds
WAC	Waste Acceptance Criteria
WQS	Water Quality Standard
WEBTAG	Web Transport Appraisal Guidance
WFD	Water Framework Directive
ZTV	Zone of Theoretical Visibility

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Definition of Terms

Annual Average Daily Traffic (AADT)

AADT is the annualised average 24-hour volume of vehicles at a given point in a section of road; normally calculated by determining the volume of vehicles during a given period and divided by the number of days in that period.

Air Quality Management Area (AQMA)

An Air Quality Management Area (AQMA) is an area where the air quality objectives are not likely to be achieved. AQMAs essentially represent areas which have an air pollution problem.

Area of Special Scientific Interest (ASSI)

An Area of Special Scientific Interest (ASSI) is an area of land that has been identified by scientific survey as being of the highest degree of conservation value at a national level.

Atterberg Limit Determination

Dependent on its water content, soil may exist in either the liquid, plastic, semi-solid or solid state. Atterberg limits are the upper and lower limits of the range of water content over which soil exhibits plastic behaviour.

Backcloth

Backcloth or backclothed is a term used (as part of a landscape assessment) to refer to a proposal in relation to the horizon or skyline.

Benefits to Cost Ratio (BCR)

BCR is an economic performance indicator. It is the ration of a projects present value benefits to its present value costs. A ratio of greater than one indicates a positive return on investment.

Chainage

Chainage is a measured length along the centreline of the new road.

Class 1 Material

General Granular Fill material

Confidential Badger Report

A badger-specific assessment and associated drawings for this scheme has been undertaken and produced. However, the drawings are confidential due to the sensitive nature of this information resulting from the history of persecution that badgers have experienced. Reference to this report is made and in ES Volume I and ES Volume II. Copies of the confidential drawings can be requested from Roads Service. A screening assessment would then be undertaken to determine if the request should be granted.

Cutting

An open excavation cut through a hill or high ground to avoid a steep incline for the new road.

dB(A)

The unit used to define a weighted sound pressure level, which correlates well with the subjective response to sound. The ‘A’ weighting follows the frequency response of the human ear, which is less sensitive to low and very high frequencies than it is to those in the range 500Hz to 4kHz.

In some statistical descriptors the ‘A’ weighting forms part of a subscript, such as L_{A10}, L_{A90}, and L_{Aeq} for the ‘A’ weighted equivalent continuous noise level.

Decibel (dB)

The ratio of sound pressures which we can hear is a ratio of 10^6:1 (one million : one). For convenience, therefore, a logarithmic measurement scale is used. The resulting parameter is called the ‘sound pressure level’ (L_p) and the associated measurement unit is the decibel (dB). As the decibel is a logarithmic ratio, the laws of logarithmic addition and subtraction apply.

Design Manual for Roads and Bridges (DMRB)

The Design Manual for Roads and Bridges (DMRB) was introduced in 1992 in England and Wales and subsequently in Scotland and Northern Ireland. It is published by The Stationary Office, London for the Highways Agency. It provides a comprehensive manual system which accommodates, within a set of loose-leaf volumes, all current standards, advice notes and other published documents relating to the design, assessment and operation of trunk roads (including motorways).

Design Year

When designing a road scheme, the capacity of the road is designed to cope with predicted road traffic numbers for a future year. This year is based upon 15 years after opening and is known as the design year.

Development Land

Development land is land identified in the local and structure plans that have been allocated for potential future development. The development may be housing, industry or business based.

Direction Order

An order made by the Department under Article 14 of the 1993 Order to designate any road or proposed road as a trunk road. Article 68 of the 1993 Order enables the Department to provide by order for the abandonment or stopping-up of roads.

Do Minimum

Do Minimum represents the future year scenario without the A8 Dualling scheme in place.

Do Nothing

Do Nothing represents the existing network without modification.

Do Something

Do Something represents the future year scenario with the A8 Dualling scheme in place.

Drumlin

A drumlin is a smooth elongated hill formed by glacial action and is generally composed of till.

Embankment

A platform of earth or rock built up to carry the new road.

Enhancement

A measure that is over and above what is required to mitigate the adverse effects of a project.

Environmental Design

The A8 Dualling scheme has progressed with continuous collaboration between the highways design and environmental requirements. Through this iterative multi-disciplinary design process, an environmental design has been developed as an integral part of the overall scheme design. This essentially means that environmental measures have been incorporated as part of the A8 Dualling scheme.

Equivalent Continuous Sound Level

An index for assessment for overall noise exposure is the equivalent continuous sound level, L_{eq}. This is a notional steady level which would, over a given period of time, deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating levels can be described in terms of a single figure level.

Frequency

Frequency is the rate of repetition of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the hertz (Hz), which is identical to cycles per second. Human hearing ranges approximately from 20Hz to 20kHz. For design purposes the octave bands between 63Hz to 8kHz are generally used.

Grade Separated Junction (GSJ)

A grade separated junction is a motorway-style junction, where vehicles travelling straight-on on the main road do not have to stop, and vehicles joining and leaving the road use slip roads.

Ground-truthing

Ground-truthing is a term used in mapping to compare data on the ground to data collected from remote sensing techniques.

HAWRAT

The Highways Agency Water Risk Assessment Tool (HAWRAT) is a tool developed specifically for the purpose of assessing pollutant concentrations as part of the water quality assessments carried out as part of a DMRB assessment.

Heavy Goods Vehicle (HGV) / Heavy Duty Vehicles (HDV)

A heavy goods vehicle (HGV) is defined as a vehicle which has a mass greater than 3.5 tonnes.

HEC-RAS

HEC-RAS is a computer program for modelling water flowing through systems of open channels and computing water surface profiles.

Herpetofauna

Herpetofauna is a branch of zoology and is a term used to describe amphibians (including the frogs, toads, and newts) and reptiles (including snakes, lizards, and tortoises).

Hydrocarbons

A hydrocarbon is an organic compound containing only carbon and hydrogen. Most motor vehicles and engines are powered by hydrocarbon-based fuels such as gasoline and diesel.

Inter-visibility

The visibility, or sightline, between two or more features, where one can be seen from another unhindered.

Landscape Character Area (LCA)

LCA's are broad assessments of the existing landscape character based on the key characteristics of the area and record notable features and typical viewpoints. LCA's divide the landscape into distinct, broadly homogenous units with defining characteristics. They are generally defined by Local Planning Authorities, in this case the Northern Ireland Environment Agency (NIEA).

Landscape Treatment Proposal

Landscape measures to reduce the effect of a scheme design on the landscape and visual resource.

L_A

A-weighted sound pressure level (in decibels, dB). The measured sound level incorporating a logarithmic base and weighting system to approximate the manner in which humans perceive sound. An increase in 10 dB is approximately equivalent to a perceived doubling of loudness.

$L_{Aeq,T}$

Equivalent continuous A-weighted sound pressure level (in decibels, dB), over a given time interval. An average of the energy associated with the noise at a location over a given time interval. Where a time interval is not given it is typically considered as a continuous level.

$L_{A10,T}$

A-weighted sound pressure level (in decibels, dB) obtained using "Fast" time-weighting that is exceeded for 10% of the given time interval. Indicates the upper limit of a fluctuating noise source such as that from road traffic. For road traffic, it is typically expressed for peak hour or as the arithmetic average of hourly L_{A10} values over an 18 hour day (06:00-24:00).

$L_{A90,T}$

A-weighted sound pressure level (in decibels, dB) obtained using "Fast" time-weighting that is exceeded for 90% of the given time interval. Defined as the background noise level at a location in BS4142.

Pinc

The probability of a spillage accident with the associated risk of a serious pollution incident occurring (in connection with DMRB Volume 11, Section 3, Part 10 HA216/06, Annex I Method D)

Platooning

Platooning refers to the grouping of traffic into clusters.

Preparation Pool

Prepartion Pool refers to high priority schemes identified by the DRD Roads Service to be taken through the statutory procedures, including acquisition of land.

QMED

Median annual maximum flood

Quadrat

A quadrat is an ecological sampling unit that consists of a square frame of known area. They are used to determine the percentage of vegetation and/animal species occurring within areas of consistent size and shape, to enable comparable samples to be obtained from different areas.

Rath

A circular hill fort protected by earthworks, used in the pre-Christian era as a retreat in time of danger.

Receptors

Receptors are defined as the physical resource or user group that would experience an effect. The effect of an environmental impact would depend on the spatial relationship between the source and the receptor. Some receptors would be more sensitive to certain environmental effects than others.

RST

Runoff Specific Threshold 24 hours refers to the 24 hour concentration limits to protect against chronic effects of surface water runoff.

RSP 6 Runoff Specific Threshold 6 hours refers to the 6 hour concentration limits to protect against accute effects of surface water runoff.

Special Area of Conservation (SAC)

A SAC is an area which has been given environmental protection under the European legislation of the Habitat's Directive because of the possible threat to the special habitats or species which they contain.

Sound Power Level

The sound power level (L_w) of a source is a measure of the total acoustic power radiated by a source. The sound power level is an intrinsic characteristic of a source (analogous to its volume or mass), which is not affected by the environment within which the source is located.

Sound Pressure Level

The sound power emitted by a source results in pressure fluctuations in the air, which are heard as sound.

The sound pressure level (L_p) is 10 times the logarithm of the ratio of the measured sound pressure (detected by a microphone) to the reference level of 2 x 10^{-5}Pa (the threshold of hearing).

Thus L_p (dB) = 10 log $(P1/P_{ref})^2$ where P_{ref}, the lowest pressure detectable by the ear, is 0.00002 pascals (ie $2x10^{-5}$ Pa).

The threshold of hearing is 0dB, while the threshold of pain is approximately 120dB. Normal speech is approximately 60dB(A) or more and a change of 3dB is only just detectable. A change of 10dB is subjectively twice, or half, as loud.

Souterrain

An artificial cave constructed for defensive purposes during the Early Medieval period. They are usually either tunnelled or trench built, the latter type being constructed usually from dry stone.

Special Protection Area (SPA)

A SPA is an area which has been designated under the European legislation on the Conservation of Wild Birds known as the Birds Directive. These sites are protected for their importance as areas for breeding, over-wintering and migrating birds.

Statistical Noise Levels

For levels of noise that vary widely with time, for example road traffic noise, it is necessary to employ an index which allows for this variation. The L_{10}, the level exceeded for 10% of the time period under consideration, and can be used for the assessment of road traffic noise (note that L_{Aeq} is used in BS 8233 for assessing traffic noise). The L_{90}, the level exceeded for 90% of the time, has been adopted to represent the background noise level. The L_1, the level exceeded for 1% of the time, is representative of the maximum levels recorded during the sample period. A weighted statistical noise levels are denoted L_{A10}, dBL_{A90} etc. The reference time period (T), is normally included, eg $dBL_{A10,\ 5min}$ or $dBL_{A90,\ 8hr}$.

Transport Users Benefit Appraisal (TUBA)

TUBA is a computer program developed for the Department for Transport to undertake the economic appraisal as part of a multi-modal transport study.

United Kingdom Technical Advisory Group (UKTAG)

UKTAG supports the implementation of the European Community (EC) Water Framework Directive (WFD) Directive 2000/60/EC. The group provides guidance on identifying and characterising water bodies and assessing the risk of these water bodies failing to achieve the WFD's environmental objectives.

Vesting

Vesting is the process of compulsory purchase of land for development.

Vesting Order

An order made by the Department under the 1993 Order and the Local Government Act (Northern Ireland) 1972 to acquire land compulsorily.

Water Quality Standards (WTS)

Water Quality Standards prescribed under the Water Directive relating to drinking water.

Web Transport Appraisal Guidance (WebTAG)

WebTAG is the Department for Transport (DfT) website which provides detailed guidance on the appraisal of transport projects and wider advice on scoping and carrying out transport studies.

Part 1 - Introduction, Project Description and Assessment of Alternatives

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1 Introduction

1.1 Introduction

This Environmental Statement (ES) documents the assessment undertaken on the potential environmental impacts of the A8 Belfast to Larne Dual Carriageway (Coleman's Corner to Ballyrickard Road) referred to within this ES as the 'A8 Dualling'. The scheme proposes the dualling of a 14km section of the existing A8 Belfast to Larne Road from single carriageway to dual carriageway standard. This ES reports on the environmental impact assessment (EIA) process.

The scheme is part of the Department for Regional Development (DRD) Roads Service's programme of Strategic Road Improvements (SRIs). This road upgrade is identified within the Investment Strategy for Northern Ireland 2008-2018 (ISNI) and the Investment Delivery Plan for Roads (IDP) and fulfils the strategic objectives of the Regional Transportation Strategy for Northern Ireland 2002-2012 (RTS) and the Regional Development Strategy for Northern Ireland 2025: Shaping Our Future (RDS).

The scheme shall be delivered under the Roads (Northern Ireland) Order 1993.

1.2 Background

The RDS identifies Larne as one of the five major inter-regional gateways in Northern Ireland, and promotes the aim to '*...continue to develop the Port of Larne which is the second largest Northern Ireland port, specialising in roll-on/roll off traffic and offering the shortest sea crossings to Scotland*.'

The RDS is supported by the 10-year RTS which is being progressed through transport plans including the Belfast Metropolitan Transport Plan 2015 (BMTP). The BMTP states '*…that options to complete the dualling of the A8 are retained*.'

The Investment Strategy for Northern Ireland 2008-2018 (ISNI) and the Investment Delivery Plan for Roads (IDP) include a number of key goals. The plans identify the A8 scheme as one of the key milestones in working toward those goals. '*...opening the A5 and remaining sections of the A8 dualling schemes during the life of the strategy*'. The IDP has therefore defined the scheme to dual the remaining 14km section of the A8, between Coleman's Corner and B100 (Ballyrickard Road), to be within its Preparation Pool[1] and estimates delivery of scheme between 2013/14 to 2017/18.

Sections of the existing A8 road carry traffic volumes of up to 17,000 vehicles per day and the road suffers surges in flow and platooning[2] at times, coinciding with ferry arrivals and departures at the Port of Larne. The road forms junctions with a high number of side roads and residential access roads which directly connect to the A8. The proposals for the improvement of the A8 involve upgrading this section of single carriageway road to dual carriageway standard.

A location plan illustrating the existing road can be seen in **Drawing A8-S3-3950, Appendix A, ES Volume II**.

[1] Preparation Pool refers to high priority schemes to be taken through the statutory procedures, including acquisition of land, in advance of funding being confirmed by the DRD Roads Service.
[2] Platooning refers to the grouping of traffic into clusters

1.2.1 Scheme Assessment Area

The scheme assessment area comprises the 14.4km section of the A8 between the Coleman’s Corner roundabout (junction with the B95 (Hillhead Road)) and the A36 (Shane’s Hill Road), and extends to approximately 500m from either side of the route. The existing road is a single carriageway with numerous side road junctions within the scheme assessment area.

The area is rural in nature, interspersed by farmsteads and isolated dwellings, minor roads and agricultural fields. The main features of the scheme assessment area are the existing A8 road itself and the settlements of Bruslee and Ballynure which are situated along the line of the existing A8.

The scheme location is illustrated on **Drawing A8-S3-3950, Appendix A, ES Volume II**.

1.2.2 Overview of the Proposed Scheme

The proposed scheme for the A8 Dualling will mostly be online; however it will bypass the small settlement of Bruslee to the east and bypass Ballynure to the west.

A number of junctions would be provided to link the new road with the wider road network. The key junctions include:

- Existing Coleman’s Corner Roundabout (B95 Hillhead Road and Camtall Road) retained with the new dual carriageway connected to the north;
- Full grade separated junction at A57 (Templepatrick Road) / B58 (Carrickfergus Road), at the point where the new dual carriageway crosses under the A57 (Templepatrick Road); and
- New roundabout midway between the A36 (Shane’s Hill Road) and the B100 (Ballyrickard Road), joining the A8, the A36 and the B100 in a single junction.

Intermediate all-movement junctions will also be provided along the A8 and include:

- Compact grade separated junction at the B95 (Calhame Road)/B95 (Green Road)/Legaloy Road;
- Compact grade separated junction at Ballybracken Road;
- Compact grade separated junction at Moss Road; and
- Compact grade separated junction at a point midway between the existing Deerpark Road and Park Road junctions.

The key objectives for Roads Service in implementing the scheme are to improve this section of the A8 to dual carriageway standard in order to reduce congestion and accidents. This scheme will also complete the final section of the eastern seaboard Key Transport Corridor (KTC). This will remove the final section of bottleneck resulting in a minimum standard of dual carriageway road for its entire length. This will lead to improvements in journey times and road safety. The scheme proposals are illustrated on **Drawings A8-S3-0001 to A8-S3-0010, Appendix B, ES Volume II**.

1.3 Environmental Impact Assessment

The environmental assessment of road construction & improvement schemes is governed by Part V of The Roads (Northern Ireland) Order 1993[3] which implemented Council Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment, as amended by Directive 97/11/EC and Directive No. 2003/35/EC of the European Parliament and Council (the Directive) must, before details of a project are published, determine whether or not the project needs an Environmental Statement (ES).

An ES is required if the project:

- Falls within Annex I to the Directive (i.e. schemes on roads of 4 or more lanes and 10km or more in continuous length or motorways.); or
- Is a 'relevant project'[4] falling within Annex II and the Department determines, having regard to the selection criteria contained in Annex III, that the project should be made subject to an environmental impact assessment.

The Department determined that the scheme fell within Annex I of the Directive and that an Environmental Statement should be prepared.

As such, this ES has been produced in accordance with the Roads (Environmental Impact Assessment) Regulations (Northern Ireland) 1999, (S.R. 1999 No. 89) and amended by The Roads (Environmental Impact Assessment) Regulations (Northern Ireland) 2007 (S.R. 2007 No. 346), identifying, describing and assessing the direct and indirect impacts on factors outlined in Annex III of the Directive.

The findings of the EIA are reported in this document, the ES.

1.4 The Environmental Statement

The preparation of this ES was undertaken in conjunction with the wider scheme assessment for the A8 Dualling scheme. The scheme assessment and environmental assessment have been undertaken in accordance with guidance developed by the Highways Agency known as the Design Manual for Roads and Bridges (DMRB[5]) and the Department for Transport's (DfT), Web-based Transport Appraisal Guidance (WebTAG).

The DMRB is a suite of guidance documents and standards designed to guide and inform the development of trunk road highway schemes in the UK from inception to construction.

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[3] Part V was substituted by the Roads (Environmental Impact Assessment) Regulations (Northern Ireland) 1999, (S.R. 1999 No. 89) and amended by The Roads (Environmental Impact Assessment) Regulations (Northern Ireland) 2007 (S.R. 2007 No. 346)

[4] 'relevant project' is defined as a project for constructing or improving a road where:
•the area of the proposed works, including working space etc, exceeds one hectare; (e.g. a 1km long scheme would exceed 1 hectare if width of works exceeded 10m); or
•it is situated in whole or in part in a sensitive area, i.e. designated an Area of Special Scientific Interest or Area of Outstanding Natural Beauty etc.

[5] The Design Manual for Roads and Bridges (DMRB) was introduced in 1992 in England and Wales and subsequently in Scotland and Northern Ireland. It is published by The Stationary Office, London for the Highways Agency.

1.4.1 The Purpose of the Environmental Statement

The purpose of ES describes the assessment of the likely environmental effects (both negative and positive) of the A8 Dualling scheme.

The ES is a document provided for the purpose of enabling decision makers to assess the likely impacts on the environment arising from the scheme. The ES also provides stakeholders and the public with a basis on which to make representations to the decision makers, as appropriate, on the environmental impacts of the scheme. The ES will be available for the general public to view. A Non Technical Summary (NTS) of the ES will also be available free of charge.

The EIA identifies the likely significant environmental impacts (both positive and negative) of the scheme and these are reported in the ES. This EIA has been undertaken following the requirements of DMRB Volume 11: *Environmental Assessment* and will:

- Examine the character of the site and the surrounding area;
- Describe the scheme including the physical characteristics of the whole development and the land use requirements during the construction and operational phases;
- Provide an outline of the main alternatives studied by the applicant with an indication of the main reasons for the choice, taking into account the environmental effects;
- Consider the interaction between the proposed scheme and the site;
- Describe the aspects of the environment likely to be significantly affected by the scheme;
- Describe a range of measures designed to avoid, minimise or mitigate any harmful effects or enhance the positive effects of the project; and
- Predict the magnitude and significance of any effects which would remain.

EIA can be divided into three distinct phases; Screening, Scoping and Assessment, which is further detailed in chapter 6 ‘Approach and Methods’.

1.5 The Assessment Team

This EIA was undertaken by Ove Arup and Partners International Limited. The team consists of environmental and engineering specialists who undertook the assessments presented in this ES in accordance with the DMRB guidance, best practice guidance, professional experience and judgement.

The assessment has been supported by a number of sub-consultants who were commissioned to undertake specialist surveys in support of this EIA. They included:

- McLorinan Consulting – Commissioned to undertake a programme of water quality sampling from watercourses within the scheme assessment area. See chapter 12, Road Drainage and the Water Environment for further details;
- Ecofact Environmental Consultants Limited – Commissioned to undertake fish population and aquatic habitats surveys of selected watercourses within

the scheme assessment area. See chapter 8, Nature Conservation for further details; and

- Dr Kerry Crawford (Bat Consultant) – Commissioned to undertake bat surveys on selected private properties within the scheme assessment area. See chapter 8, Nature Conservation for further details.
- As part of the wider scheme assessment process an agricultural consultant (McIlmoyle and Associates) was appointed to undertake individual Agricultural Impact Assessments (AIAs) for agricultural landowners who may be affected by the scheme. The results of this assessment have been used to inform the assessment of effects upon agricultural land as detailed within chapter 16 'Community and Private Assets'.

1.6 Report Structure

The Environmental Statement is divided into three volumes:

ES Volume I

ES Volume 1 is presented in three parts – Part 1, Part 2 and Part 3.

Part 1 provides the context, giving background details about the various options/choices considered, information about the site and its surrounding area and the development proposals.

Part 2 provides the assessment and identifies the effects likely to occur with regard to the operation of the scheme. This section considers effects of the proposals on nature conservation, landscape, cultural heritage, materials, road drainage and the water environment, noise, air quality, all travellers (pedestrians, cyclists, equestrians and vehicle travellers) and community and private assets. This section also considers the planning framework for the scheme and policy compliance.

Each chapter in Part 2 of ES Volume I, is presented as follows:

- Overview of relevant legislation and guidance;
- Details of the scoping and consultation process undertaken;
- Details of the assessment and survey methodology;
- Review of limitations and assumptions;
- Details of baseline conditions, including desk study data relating to designation information and results of survey work undertaken;
- Overview of how environmental mitigation has been incorporated into the design of the proposed scheme, i.e. environmental design;
- Assessment of the effects of the scheme during construction and operation;
- Mitigation of the effects of the scheme during construction and operation; and
- Assessment of the residual effects of the scheme during construction and operation.

Some chapters provide specific significance criteria, in addition to those identified in chapter 6.2.6 , as these disciplines have specific significance criteria (e.g.

ecology, landscape and water environment) that are accepted as general best practice.

Part 3 provides a summary of the environmental assessments detailed in Part 2, in the form of environmental impact summary tables.

ES Volume II – ES Appendices

A series of drawings and additional technical reports have been prepared and are presented separately in the ES Volume II Appendices Report. In this document, where reference is made to an Appendix, this refers to the appendices contained in Volume II Environmental Statement Appendices.

ES Volume III - Non-Technical Summary

A non-technical summary forms part of the ES as required by the Regulations. It is presented separately as Volume III.

1.6.1 Subject Areas within the Environmental Statement

This ES addresses the following subject areas as required by DMRB Volume 11:

- Nature Conservation;
- Landscape;
- Cultural Heritage;
- Geology and Soils;
- Road Drainage and the Water Environment;
- Noise and Vibration[6];
- Air Quality;
- Effects on All Travellers; and
- Community and Private Assets.

Some of the chapter headings for the ES have been changed from the topic guidance titles of Volume 11, Section 3 to follow the updated structure of DMRB Volume 11 as detailed in Section 1, Part 1. The chapters have been adopted and reported under the chapter structure outlined above. These changes are in respect of proposed future changes to DMRB Volume 11.

Topic guidance documents within DMRB (Volume 11, Section 3) will be updated by the Highways Agency in due course to reflect the new structure. This EIA has been undertaken in accordance with the current DMRB guidance at the time of writing. Please note the following change of title descriptions:

- ‘Nature Conservation’ from ‘Ecology and Nature Conservation’;
- ‘Effects on All Travellers’ from ‘Vehicle Travellers’ and ‘Pedestrians, Cyclists and Equestrians and Community Effects’; and
- ‘Community and Private Assets’ from ‘Pedestrians, Cyclists, Equestrians and Community Effects’ and ‘Land Use’.

[6] Noise and Vibration heading has been adopted to align with DMRB Interim Advise Note (IAN 125) which details the new DMRB Volume 11, Section 3 chapters. Published October 2009.

- There is no current guidance on Materials for schemes in Northern Ireland or general guidance on Materials for the UK. Therefore, an assessment on Materials is not included in this ES. An assessment on Geology and Soils is included.

1.7 Review and Comments

The complete ES would be deposited for public inspection during normal opening hours at the following locations:

- Roads Service Headquarters

  Room 2-13

  Clarence Court

  10-18 Adelaide Street

  Belfast

  BT2 8GB

- Roads Service – Northern Divisional Headquarters

  County Hall

  Castlerock Road

  Coleraine

  BT51 3HS

- Roads Service – Eastern Divisional Headquarters

  Hydebank

  4 Hospital Road

  Belfast

  BT8 8JL

- Newtownabbey Borough Council

  Mossley Mill

  Newtownabbey

  BT36 5QA

- Larne Borough Council

  Smiley Buildings

  Victoria Road

  Larne

  BT40 1RU

A CD of the full ES (Volumes 1 and 2) is available free of charge from Roads Service at the above address. Hard copies are available on request.

Copies of the Non-Technical Summary of the ES are available free of charge from Roads Service at the above address and via the Roads Service website www.roadsni.gov.uk.

The ES is also available via the Roads Service website.

Any person who wishes to express an opinion on this ES or to object to the making of The Trunk Road T9 (Coleman's Corner to Ballyrickard Road) Order (Northern Ireland) 2011, The Private Accesses (Coleman's Corner to Ballyrickard Road) Stopping-Up Order (Northern Ireland) 2010, or the proposed vesting order must, on or before 11 March 2011, write to the contact below, stating their opinion on the ES and/or the grounds of their objection to the proposed orders. Comments regarding any of the information presented within this ES should be made to:

Divisional Roads Manager

Department for Regional Development

Roads Service – Northern Division

County Hall

Castlerock, Coleraine

BT51 3HS

Phone: 028 70341379

Fax: 028 70341442

Email: roads.northern@drdni.gov.uk

2 Need for the Scheme

2.1 Policy and Strategic Context

The RDS: Shaping Our Future guides the development of Northern Ireland to 2025. One of the priorities of the strategy with respect to supporting economic development is *'to promote regional gateways as economic development opportunities.'* It identifies Larne as one of the five major inter-regional gateways in Northern Ireland, and under this priority, the strategy promotes the aim to *'continue to develop the Port of Larne which is the second largest Northern Ireland port, specialising in roll-on/roll off traffic and offering the shortest sea crossings to Scotland.'*

The RDS is supported by a 10-year RTS 2002-2012 which aims to make significant contributions towards achieving the longer-term vision for transport put forward by the RDS, which is *'… to have a modern, sustainable, safe transportation system which benefits society, the economy, and the environment and which actively contributes to social inclusion and everyone's quality of life...'*.

The RDS and RTS aim to develop a Regional Strategic Transport Network, based on KTCs. The A8 forms part of the Eastern Seaboard Corridor which encompasses road and rail links between the Belfast Metropolitan Area, Dublin and Larne. Delivery of the detailed content of the strategy is being progressed through three transport plans; the RSTN TP, the Belfast Metropolitan Transport Plan (BMTP) and the Sub-Regional Transport Plan (SRTP).

BMTP outlines that '*The A8 is the strategic link between Belfast, via the M2, to the Regional Gateway of Larne. It forms a key element of the RSTN and has been improved with road widening schemes and heavy goods vehicle crawler lanes in recent years. The Plan proposes that options to complete the dualling of the A8 are retained*.'

The Investment Strategy Northern Ireland (ISNI), in particular the Investment Delivery Plan (IDP) for Roads, provides opportunities for improving both the inter-urban and local road network. For the period of the Investment Strategy, Roads Service's indicative budget has risen to £3.1 billion over the 10 year period (2008 - 2018). Of this amount Roads Service propose to invest just under £2.5 billion in Strategic Road Improvements (SRIs), of which £2.1 billion is for dualling projects on the KTCs. The ISNI includes a number of key goals and milestones and includes *'opening the A5 and remaining sections of the A8 dualling schemes during the life of the strategy'*.

The IDP, which provides additional details on future infrastructure investments, states that '*Roads Service believe meeting the Regional Development Strategy objectives will require upgrading of all key transport corridors to at least dual carriageway standard*'. The IDP also identifies the '*A8 improvements will further enhance the link from the Port of Larne to Belfast and Dublin*'. The scheme is currently in the Roads Service Preparation Pool[7], with an estimated delivery of

[7] Prepartion Pool refers to high priority schemes identified by the DRD Roads Service to be taken through the statutory procedures, including acquisition of land.

between 2013/14 to 2017/ and estimates delivery of the scheme between 2013/14 to 2017/18.

2.2 Existing Traffic Conditions

The section of the A8 between Coleman's Corner and the B100 (Ballyrickard Road) is a 14km stretch of single carriageway road. Sections of the road carry traffic volumes of up to 17,000 vehicles per day and the road suffers surges in flow and platooning[2] at times coinciding with ferry arrivals and departures at the Port of Larne.

A number of traffic studies and extensive data collection have been carried out as part of the assessment process and consequently, there are a number of separate, detailed reports[8] containing the methodologies of traffic work undertaken. The traffic studies have shown the traffic volumes on the A8 vary along this section. The traffic volumes between Coleman's Corner roundabout and the A57 Templepatrick Road are approximately 11,000 vehicles per day. The volumes around and through Ballynure increase to approximately 17,000 vehicles per day, and then north of Ballynure they reduce to approximately 15,000 vehicles per day.

There is no absolute measure that can be said to represent the "capacity" of a link in the highway network; it is simply a matter of decreasing speeds, deterioration of operating conditions, or a declining level of service as perceived by users. In the DMRB, the concept of the Congestion Reference Flow (CRF) is used to provide a measure against which to judge acceptable performance. If the ratio of flow to CRF is 100%, it is advised that '*the carriageway is likely to be congested in the peak periods on an average day*'. However problems may occur before the ratio of flow to CRF is equal to 100%. Journey time reliability is said to be affected and 'driver stress' begins to be experienced when the ratio reaches 75% (WebTAG Unit 3.5.7, Section 2).

In 2008 the section of the existing A8 between Ballynure and the B100 was assessed to have a CRF of 67%. For the opening (2016) and design years (2031), the CRFs would be further increased respectively to approximately 80% and 86% between Ballynure and the B100. The ratio of flow to the CRF on the section of the A8 around Ballynure would be even higher with a value of approximately 92% in the design year (2031). The CRF figures indicate that operational problems such as unstable flow conditions and unreliable journey times, especially during peak periods, are likely to occur frequently by 2016. The future traffic flows are forecast to be close to the CRF by the year 2031, for some sections of the A8, which will result in significant further deterioration of traffic conditions.

Road Traffic Collision (RTC) statistics have been analysed for this section of the A8 for the period between 2005 to 2009. In this period, 51 accidents were recorded and the statistics showed that accidents on this section of the A8 are approximately a third of what would be expected for this type of road. However,

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[8] A8 Belfast to Larne Dual Carriageway (Coleman's Corner to Ballyrickard Road): Stage 1 Scheme Assessment Report.
A8 Belfast to Larne Dual Carriageway (Coleman's Corner to Ballyrickard Road): Local Model Validation Report.
A8 Belfast to Larne Dual Carriageway (Coleman's Corner to Ballyrickard Road): Traffic Forecasting Report.

the proportion of fatal accidents is significantly higher than expected; 10% on the A8 compared to 4% for a typical road of this standard.

2.3 Conclusion

The existing A8 between Coleman’s Corner and the Ballyrickard Road is a key link within Northern Ireland’s road network providing a link to the key gateway of the Port of Larne, therefore promoting the economic development of the province. Key Northern Ireland strategy, policy and development plans place the dualling of the A8 as a critical part of promoting development and encouraging growth. The dualling of the A8 is identified, alongside the dualling of the A5, as one of the ten key network milestones within the ISNI. In addition, the milestone is specific about the opening the scheme within the lifetime of that strategy (2008-2018).

The existing road carries between 11,500 and 17,000 vehicles per day and by 2016, it is likely to suffer from operational problems such as unstable flow conditions and unreliable journey times, especially during peak periods. The existing road forms junctions with a high number of side roads and residential access roads which directly connect to the main carriageway, and the road suffers from a high proportion of fatal accidents. Although climbing lanes have been recently constructed on either side of the village of Ballynure, there are a restricted number of overtaking opportunities along the remainder of the scheme and platooning occurs at times coinciding with ferry arrivals and departures at the Port of Larne.

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3 Environmental Issues

3.1 Introduction

This ES has been supported by the information and assessments undertaken at earlier stages in the development of the A8 Dualling scheme. A summary of the stages undertaken is presented in chapter 3.2. All of the stages of the scheme assessment have been undertaken in accordance with the guidance of the DMRB and Web-based Transport Appraisal Guidance (WebTAG[9]).

3.2 Previous Environmental Studies

The scheme assessment was a three stage process, which included an environmental study at each stage. A brief summary of the three stages and the previous environmental studies are outlined.

Stage 1- Preliminary Assessment and Identification of Constraints

The Stage 1 assessment was largely a desk-based exercise making use of published information and a series of initial site visits and surveys, information collection and review, identification and mapping of constraints and liaison with relevant departments and stakeholders. The preliminary assessment was conducted at the 'broadly defined route corridor' level. The output of Stage 1 was the recommendation of a range of preferred corridors to be taken forward to Stage 2. The assessments were undertaken in accordance with DMRB (Stage 1 as outlined in the specific topic guidance) and the Department for Transport's (DfT), WebTAG[9].

Stage 2- Options Appraisal

The Stage 2 assessment involved a more detailed DMRB and a WebTAG assessment and appraisal. This included additional more detailed surveys to identify the key effects and factors to be taken into account when selecting and comparing alignment options and to assist in the identification and selection of a preferred alignment. The output of Stage 2 was the 'Preferred Route'.

Stage 3 - Detailed Assessment of the Proposed Scheme

The Stage 3 assessment has involved further design development of the Preferred Route into a preliminary design.

This stage of the assessment has required completion of an EIA of the Preliminary Design and the preparation of this ES in accordance with the Roads (Environmental Impact Assessment) Regulations (Northern Ireland) 1999, (S.R. 1999 No. 89) and amended by The Roads (Environmental Impact Assessment) Regulations (Northern Ireland) 2007 (S.R. 2007 No. 346), implementing EC Directive 85/337, as amended by Council Directive 97/11. In addition, draft

[9] WebTAG is the Department for Transport (DfT) web based resource which provides detailed guidance on the appraisal of transport projects and wider advice on scoping and carrying out transport studies.

Vesting[10], Direction[11] and Private Accesses Stopping-Up Orders[12] have also been produced for planning and land acquisition.

[10] Vesting Order – An order made by the Department under the 1993 Order and the Local Government Act (Northern Ireland) 1972 to acquire land compulsorily.
[11] Direction Order – An order made by the Department under Article 14 of the 1993 Order to designate any road or proposed road as a trunk road. Article 68 of the 1993 Order enables the Department to provide by order for the abandonment or stopping-up of roads.
[12] Private Accesses (Coleman's Corner to Ballyrickard Road) Stopping-Up Order (Northern Ireland) 2010 - An order made by the Department under Article 69 of the 1993 Order to stop up the access to private land or make provision for a new means of access to the land.

4 Background to the Scheme

4.1 Introduction

This chapter provides an overview of the development of this scheme, providing a brief description of the alternatives considered and the conclusions of the environmental assessments which inputted into the selection of the Preferred Route.

In November 2007, the Northern Ireland Roads Service issued the project brief 'A8 Route Corridor Study Consultancy Services'. This brief outlined the Roads Service requirements to deliver the A8 Belfast to Larne Dual Carriageway. A number of scenarios and alternative designs have since been developed and are described in the following sections.

The selection of the Preferred Route was made considering the Government's five key objectives for transport as described within the Department for Transport's New Approach to Appraisal (NATA) which include:

- Safety;
- Environment;
- Economy;
- Integration; and
- Accessibility.

At each stage of the process, the environmental implications of each option/route were considered together with the other four government objectives and not as a stand-alone decision making consideration.

Additional information and opinions gained from the general public at public consultation events, feedback forms and through the Environmental Liaison Group (ELG) meetings with statutory and governmental consultees and other ongoing partnerships were also used to inform the selection of options.

4.2 Other Options

4.2.1 Do Nothing Scenario

Under the Do Nothing scenario, the Northern Ireland Road Service would continue to actively manage the existing road infrastructure between Coleman's Corner to the B100 (Ballyrickard Road) through sustaining a regular maintenance programme and operational management as required. This scenario would not include improvement schemes to alter the existing alignment or junction arrangement of the road. Traffic is forecast to include standard national growth figures and any future increases from committed development schemes. This scenario does not include committed road network changes.

As outlined in chapter 1.2, the RDS guides the development of Northern Ireland to 2025. The RDS identifies Larne as one of the five major inter-regional gateways in Northern Ireland, and under this priority, the strategy promotes the aim to *'continue to develop the Port of Larne which is the second largest*

Northern Ireland port, specialising in roll-on/roll off traffic and offering the shortest sea crossings to Scotland.' The RDS is supported by the RTS.

The A8 forms part of the Eastern Seaboard Corridor which encompasses road and rail links between the Belfast Metropolitan Area, Dublin and Larne. Delivery of the detailed content of the strategy is being progressed through the RSTN TP, the BMTP and the SRTP.

The Do Nothing Scenario was considered during the preparation of the RDS and the RTS. At this stage the Do Nothing scenario was not considered to provide the identified capacity needed to meet the requirements of national and regional strategies and therefore was not taken forward as a possible option.

4.2.2 Do Minimum Scenario

The Do Minimum scenario would continue actively managing the road infrastructure between Coleman's Corner to the B100 (Ballyrickard Road) through sustaining a regular maintenance programme and operational management as required. This scenario would not include improvement schemes to alter the existing alignment or junction arrangement of the road. Traffic is forecast to include standard national growth, any future increases from committed development schemes and committed road network changes.

As with the Do Nothing scenario, the Do Minimum scenario was considered during the preparation of the RDS and the RTS. This scenario was also not considered to provide the identified capacity needed to meet the requirements of national and regional strategies and therefore was not taken forward as a possible option.

4.3 Alternatives Considered

The RDS and RTS provide the strategic policies and plans for the development and transport strategies for Northern Ireland until 2025. As detailed above the consideration of the Do Nothing and Do Minimum scenarios for the A8 were considered and deemed not to be acceptable for the future demand and need along the route.

Strategic Environmental Assessment Directive 2001/42/EC (SEA Directive) aims to identify the effects of certain plans and programmes on the environment. The RDS and RTS are currently the subject of a SEA.

'...to provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans with a view to promoting sustainable development.'

In January 2009 the DRD published the SEA Scoping Reports for both the RDS and the RTS.

4.3.1 Stage 1 – Corridor Assessment Options

Following the decisions developed through the RTS and RDS that a dualling scheme was required options for widening the existing route were considered. A corridor optioneering assessment for the scheme was completed in November 2008. This was a 'corridor' assessment and broadly identified the environmental, engineering, economic, and traffic advantages, disadvantages and constraints associated with a range of corridors considered. These corridors included both online and off-line options for a new dual carriageway between Coleman's Corner and the B100 (Ballyrickard Road).

The corridor and route options assessments were undertaken in accordance with the DMRB Volume 11[18] and WebTAG[9]. The findings of the study were presented within the Stage 1 Scheme Assessment Report[8] in accordance with the Government's five key objectives of environment, safety, economy, accessibility and integration. Consideration was also given to engineering and traffic impacts.

The summary of significant environmental effects for each corridor and route option presented within this chapter was considered together with similar assessments of the other Government objectives detailed above. The examination of all of these assessments influenced the final decision to proceed with the selected corridors and routes detailed in the subsequent sections of this chapter.

Eight corridors were considered for the assessment and comprised a mixture of online and off-line corridors (see **Drawing A8-S3-3952, Appendix B, ES Volume II**). The off-line corridors included options to both the east and west of the existing A8 and are described in Table 1**.**

Table 1 **Corridor Assessment Options**

Corridor Option	**Description**
Corridor 1 Online Central:	This corridor sought to provide a completely online dualling solution along the A8 and through Ballynure. A dual carriageway within this corridor would be delivered through the widening of the existing A8 road. The corridor sought to maximise the use of the existing highway infrastructure and build upon the already established highway corridor through the study area. Whilst the corridor aimed to minimise the impact on properties that front onto the existing A8, some impact would be unavoidable.
Corridor 2 Online East:	This corridor was the same as Corridor 1 for the majority of the scheme and sought to provide an online dualling solution. However, Corridor 2 removed the A8 from the centre of Ballynure and provided a bypass to the east of the village.
Corridor 3 Online West:	This corridor adopted the same principles as Corridor 2 by removing the A8 from Ballynure while seeking to provide an online dualling solution. Corridor 3, however, provided a bypass to the west of the village.
Corridor 4 Online Link Road:	Online dualling solution either side of Ballynure. However, Corridor 4 would incorporate the existing link road constructed to the southeast of Ballynure as part of the bypass, and then extend the bypass around the village to re join the existing road corridor.
Corridor 5 Off-line West:	Corridor 5 sought to deliver a predominantly off-line dualling scheme, to the west of the existing road. The existing road would be retained for the local traffic usage.
Corridor 6 Off-line East:	Corridor 6 delivered a completely off-line dualling scheme between Coleman's Corner and the B100 (Ballyrickard Road) to the east of the existing road. The existing road would be retained for local traffic usage.
Corridor 7 Part Off-line East:	This corridor maximised the use of the existing A8 corridor for the southern half of the scheme, to a point south of the A57 (Templepatrick Road) roundabout. At this point the corridor moved off line to the east and provided an off-line solution for around Ballynure and for rest of the

Corridor Option	Description
	scheme (which carries a higher proportion of traffic than the southern section).
Corridor 8 Part Off-line West:	Corridor 8 delivered a part off-line solution similar to Corridor 7. However, this corridor provided an off-line corridor to the west of Ballynure and the existing A8.

An environmental assessment was undertaken of the corridor options in order to identify the main environmental aspects which provided some differentiation between the corridors. This identified environmental and social features which may be affected by the proposals and identified differences in the magnitude of impacts between the different corridor options. Significant differences were identified for land use, heritage, landscape and nature conservation resources.

The off-line corridors had a significant impact on several environmental topics. The impact upon land use, most notably the loss of best and most versatile agricultural land and associated severance of farms, as well as the impact on local archaeological assets was assessed to be highest with the off-line corridors. The off-line options would also physically impact on the landscape as a new route would pass through a predominantly agricultural context. In addition, the loss of, or damage to local non-statutory nature sites would be most acute from the off-line corridors. The fully off-line options were therefore considered to perform negatively in terms of environmental performance.

A fully online corridor performed poorly in terms of impact upon the character and townscape of Ballynure, and particularly increased the adverse impacts on the community aspects and increased severance of the village. Outside of the village, online widening provided a better environmental solution, than off-line corridors. This was due to less land-take with less habitat loss and impacts to known and unknown archaeology.

The best performing corridors were those which contained the benefits of the on-line corridors, but provided opportunities for a bypass around the key settlements, removing or reducing the negative aspects associated with community severance, townscape and visual impacts.

The wider corridor assessment[15] recommended that two corridors should be taken forward into the route assessment. These were Corridors 2 and 3 on the basis that they were considered to be among the best performing corridors because they minimised environmental impact, improved the current severance issues within Ballynure, and were the best performing routes in terms of the economic assessment.

4.3.2 Stage 2 - Route Options Assessment

Following the corridor assessment, the two corridor options were developed further to consider route options within the defined corridors. The two corridors options were:

- Corridor 2 – Online East Corridor; and
- Corridor 3 - Online West Corridor.

For the purpose of assessment and route design the road corridor was split into three sections for which a number of route options were developed as shown on **Drawing A8-S3-3952, Appendix B, ES Volume II**. The sections were:

Section A Bruslee – comprised three routes (Routes A1, A2 and A3) between Coleman's Corner and Calhame Road.

Section B Ballynure – comprised six routes (Routes B1, B2, B3, B4, B5 and B6) between Calhame Road south of Ballynure, to north of Ballynure and Junction Lane.

Section C Northern – Comprising one route (Route C1) between Junction Lane and the B100 (Ballyrickard Road).

The findings of the assessment were presented within the Stage 2 Scheme Assessment Report[13].

A summary of the level of significance predicted for each section of the route options is provided in Table 2 for the key environmental topics considered in this assessment.

Table 2 **Summary of significance for the route options**

Symbol	Definition
X	Slight Adverse Impact
XX	Moderate Adverse Impact
XXX	Large Adverse Impact
-	Neutral Impact
✓	Slight Beneficial Impact
✓✓	Moderate Beneficial Impact
✓✓✓	Large Beneficial Impact

4.3.2.1 Section A

The three proposed route options for this section included Route A1, A2 and A3.Route A1, an online route which would have included the demolition of several houses and community features to accommodate a widened road. Routes A2 and A3 were off-line routes bypassing the village to the east.
Table 3 outlines a summary of the findings of the Section 'A' DMRB[18] corridor assessment.

[13] A8 Belfast to Larne Dual Carriageway (Coleman's Corner to Ballyrickard Road): Stage 2 Scheme Assessment Report

Table 3 **Summary of the Section A Corridor Assessment Options**

Environmental Topics		**Route Option**		
		A1	**A2**	**A3**
Air Quality		X	X	X
Cultural Heritage		X	X	X
Landscape		X	XX	XX
Nature Conservation		X	XX	XX
Geology and Soils		X	X	X
Noise and Vibration[14]	Short Term	X	X	XX
	Long Term	XX	XX	XX
Effect on All Travellers		-	✓✓	✓✓
Community and Private Assets	Community	XXX	✓	✓
	Private Assets	XXX	X	X
Water Environment		X	X	X

Overall the distinguishing environmental issues for Section A were impacts to community and private assets and noise. The off-line options, in particular A3, would result in the worst environmental performance for landscape, nature conservation and noise. Impacts to community and private assets were large adverse from the online option (A1), which resulted in the most significant impacts within Section A. Due to these issues the preferred environmental route for Section A was considered to be marginally (over route A3) in favour of Route A2.

Based upon the wider assessment[15] of the three route options within Section A, it was recommended that the option preference was Route A2. This was based on the route having the smallest impact on Bruslee through reductions in severance and demolition of properties (alongside Route A3), the least environmental impact, and the best economic performance.

4.3.2.2 Section B

Six possible routes were assessed for Section B. These all comprised a bypass of Ballynure, comprising four routes to the west of the village and two routes (B4 and B5) to the east. Table 4 outlines a summary of the findings of the Section B DMRB[18] corridor assessment.

[14] The noise assessment identified both beneficial and adverse effects for receptors along each of the route options considered. The summary tables have tried to represent the most significant 'worst case' scenario impacts.
[15] The wider assessment considered the findings of the DMRB assessment, the supporting WebTAG assessment and comparison based upon the Government's five key objectives of safety, environment, economy, integration and accessibility as described within NATA.

Table 4 **Summary of the Section B Corridor Assessment Options**

Environmental Topic		**Route Option**					
		B1	**B2**	**B3**	**B4**	**B5**	**B6**
Local Air Quality		X	X	X	X	X	X
Cultural Heritage		X	XX	X	XX	XX	X
Landscape		XX	XX	XX	XX	XX	XX
Nature Conservation		XX	XX	XXX	XX	XX	XX
Geology and Soils		XX	X	X	X	X	X
Noise and Vibration[14]	Short Term	XX	XX	XX	XX	XX	XX
	Long Term	XXX	XXX	XX	XX	XX	XX
Effect on All Travellers		✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Community and Private Assets	Community	✓	✓	✓	✓	✓	✓
	Private Assets	XX	XX	XX	XX	XX	XX
Water Environment		X	X	XX	X	X	X

Overall the distinguishing environmental issues relevant to Section B were the adverse impacts to nature conservation, water and noise effects. Routes B1 and B3 would have involved greater adverse impacts to Ballynure Water and Six Mile Water, which could not be mitigated, thereby Routes B1 and B3 were considered to be the worst performing routes. The remaining four routes had an even spread of adverse and beneficial impacts between them, however in the context of this scheme and its locality it is considered that greater weighting should be given to impacts to landscape and cultural heritage which would result in a better environmental performance from Routes B6, followed by B2 in the west and the eastern Route B4.

The wider assessment[15] of the six routes within Section B recommended Route B6. This was based on the route delivering the best economic performance, the least environmental impact (alongside other routes), the greatest reduction in through traffic in Ballynure delivering a safer and better environment within the village, and the avoidance of residential properties.

4.3.2.3 Section C

Section C comprised a single option which was a widening along the existing road corridor. Within this assessment key environmental and social features were identified and contributed to the choice of which side of the road would be widened.

Table 5 outlines a summary of the findings of the Section C DMRB[18] corridor assessment.

Table 5 **Summary of the Section C Corridor Assessment Options**

Environmental Topic		**Route Option**
		C1
Air Quality		X
Cultural Heritage		XX
Landscape		XX
Nature Conservation		XX
Geology and Soils		X
Noise and Vibration[14]	Short Term	X
	Long Term	XX
Effect on All Travellers		✓
Community and Private Assets	Community	-
	Private Assets	XX
Water Environment		XX

There were no large adverse impacts predicted along this route and where moderate impacts were identified, detailed design and mitigation measures would be developed to reduce these further.

4.4 Conclusion

4.4.1 Preferred Route

The wider comparison of the route options assessments with the Government's five key objectives lead to the final selection of the Preferred Route. The recommended Preferred Route taken forward to Stage 3 was a combination of Routes A2, B6 and C1, which is an online widening scheme with an eastern bypass of Bruslee and a western bypass of Ballynure.

The assessment concluded that these options would produce the most beneficial combination. This was determined based on the DMRB Volume 11[18] assessment, the supporting WebTAG assessment and comparison of the options against the Government's five overarching objectives for transport (safety, environment, economy, integration and accessibility). A full description of the scheme is provided in chapter 5 '*The Proposed Scheme*' and illustrated in **Drawings A8-S3-0001 to A8-S3-0010, Appendix B, ES Volume II.**

5 The Proposed Scheme

5.1 Introduction

The proposed scheme involves upgrading the existing A8 between Belfast and Larne therefore completing a minimum of dual carriageway standard along the eastern seaboard key transport corridor. This will lead to improvements in journey times, road safety and better access to Larne, and sea-crossings to Scotland and England via the Port of Larne.

5.2 Scheme Procurement

The proposed A8 scheme is being delivered through a form of early contractor involvement, and in early 2010 a contractor was appointed to form part of an Integrated Delivery Team (IDT). The contractor was appointed to provide advice and input during the scheme preparation phase, and then subject to the successful outcome of the statutory procedures, a positive economic appraisal and the availability of funding, the contractor will then undertake the detailed design and construction of the scheme.

During the scheme preparation phases, prior to the publication of the ES and Draft Orders, the focus of the IDT with the contractors input has been on whether the preliminary scheme design could be refined to reduce the impact on local landowners and the environment and deliver better value for money. This has included consideration of the design in more detail and the contractor has also provided input on construction activities and processes, the potential programme and land requirements.

5.3 Design of the Preferred Route

The Preferred Route developed during Stage 2 has been further assessed and developed to produce a preliminary scheme design which is inclusive of both engineering design and environmental design elements.

5.3.1 Environmental Design

A series of measures have been developed as part of the EIA and scheme design process, this is referred to as environmental design. Environmental design has been integral to the scheme and has followed the guidance outlined in DMRB Volume 10 Environmental Design and Management. Updates on this guidance and other best practice guidance available, is referenced in the individual discipline methodologies.

Through an iterative multi-disciplinary design process, an environmental design has been developed along with the engineering design to produce an overall preliminary scheme design, as illustrated in Figure 1. It is this design which is the subject of the EIA.

Environmental design measures have been incorporated as part of the dualling scheme and are not considered to be additional environmental mitigation measures. Therefore, the scheme is assessed as a complete scheme design which incorporates measures to protect or reduce the environmental impact.

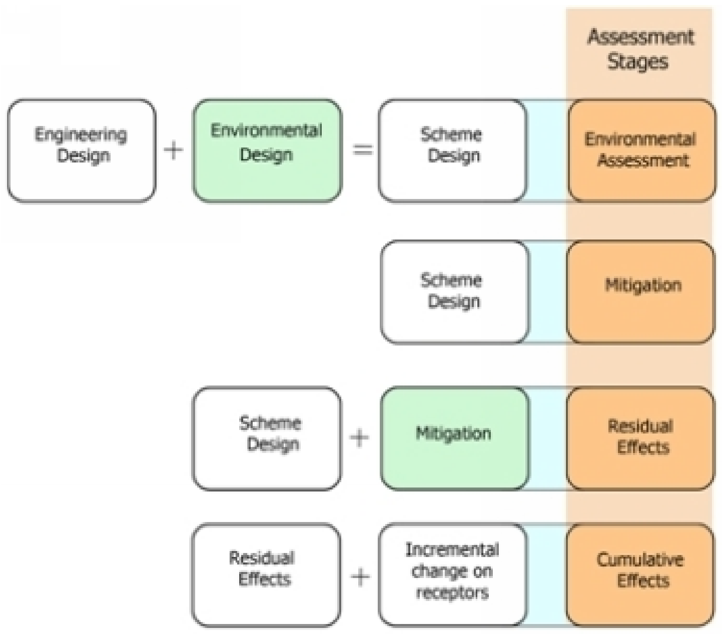
Where further measures would be required to mitigate any potential adverse effects, in addition to the scheme design, theses are outlined in the specific topic chapters.

Residual effects are identified as the effects which remain after mitigation measures have been adopted into the scheme design.

Effects that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the scheme are referred to as ‘cumulative effects’ and are also identified within each topic assessment.

Figure 1 illustrates this process.

Figure 1 **Scheme and Environmental Design Process**



Detailed information on the environmental design measures incorporated in the preliminary design is illustrated within the environmental masterplan drawings, **Drawings A8-S3-3900 to A8-S3-39XX, Appendix M, ES Volume II**. The main elements of environmental design are outlined in Table 6.

Table 6 **Environmental Design Proposals**

Environmental Design Discipline	**Description of Environmental Design Elements included in the Preliminary Design**
Landscape	*Embankment and Cutting Slope Profile* Profile changes between the new and the artificial gradients and the existing natural topography. The crest and the toe of embankments and cutting slopes have been designed to be sympathetically profiled to create a gradual transition and reflect the drumlin landscape. *Tree and Shrub Planting* Residential properties are considered to have a high visual sensitivity. Screening has been considered to reduce the adverse visual effects on these receptors. *Extend Woodland Edge* Woodland planting has been included in the planting and landscape

Environmental Design Discipline	Description of Environmental Design Elements included in the Preliminary Design
	design to integrate the alignment and reflect the existing landscape character. *Replacement Hedgerows and Walls* Existing vegetation in close proximity to the dualled A8 would be protected and retained where possible. Hedgerows and dry stone walls along the existing road lost during construction would be reinstated. *Planting Areas – Growing Medium* A suitable growing medium for proposed planting areas has been agreed and forms part of the engineering design and the land take requirements, ensuring the establishment of the proposed planting. *Hedgerow Planting* Boundary hedgerows lost during construction and proposed hedgerows will be replaced and designed and planted in accordance with the DARD Countryside Management Scheme (2007-2013) information booklet. *Attenuation Ponds* Attenuation ponds are proposed within the preliminary scheme design, and they will be sympathetically designed to integrate the pond into the landscape to reflect the contours of the adjoining topography. *Rock Cutting Treatment* Exposed rock cutting will be designed to add visual interest, provide a sense of place and act as a landmark. *Junction Arrangement* Areas of dense planting are proposed to develop a strong landscape statement, screen views and integrate the full grade and compact grade separated junctions into the surrounding landscape.
Nature Conservation	*Badgers* Where appropriate replacement setts would be provided for those which have been identified by the baseline surveys as requiring closure. Badger underpasses and fencing has been included in the preliminary scheme design to ensure safe foraging on both sides of the road. Subject to future surveys prior to construction, the extent of this fencing may vary based on findings. *Otters* Where appropriate, otter ledges and fencing have been incorporated into the design of culverts and structures which have been identified by baseline surveys. *Bats* Appropriate hedgerow and hop over planting has been incorporated into the planting design to facilitate bats crossing the carriageway at identified key locations to roost and forage.
Cultural Heritage	*Lowtown Rath* Appropriate planting and ‘like for like’ replacement of the hedgerow boundary has been included to maintain the scheduled area surrounding the historic monument.
Road Drainage and the Water Environment	*River Realignments and Geomorphologic Design* Five proposed river realignments have been designed to include geomorphologic design features to minimise the environmental impact upon the aquatic environment and fisheries. Full details of the design features are described within the Geomorphological Impact Assessment Report, **Appendix L, ES Volume II**. Petrol Interceptors and attenuation ponds are incorporated into the preliminary scheme design.

Environmental Design Discipline	Description of Environmental Design Elements included in the Preliminary Design
All Travellers	*Footways and Cycleways* A minimum 2.0m wide shared footway/cycleway is to be provided along the length of the eastern carriageway (with the exception of the Ballynure bypass) and minimum 1.5m wide intermittent footways along the western carriageway. These will link all properties to bus stops, crossing facilities within the main junctions, and the various community facilities available within the settlements of Bruslee and Ballynure.

5.4 Outline of the Proposed Scheme

The following sections detail the specific highway design elements of the new dual carriageway. The full scheme is illustrated in **Drawings A8-S3-0001 to A8-S3-0010, Appendix B, ES Volume II**.

The proposed A8 Dualling consists of 14.4km of new high speed dual two lane rural carriageway with a national speed limit of 70mph. The typical carriageway width would be 21.1m (excluding verges), increasing in width to accommodate forward visibility requirements and bridge piers as required, with embankments and cuttings slopes rounded top and bottom to integrate the earthworks into the surrounding topography and landscape. The carriageway verges would vary in width depending on whether they include a footway/cycleway and/or safety barrier and lighting columns.

The scheme would include the following junctions:

Two all-movement roundabouts at each end of the scheme;

- The B95 (Hillhead Road) (existing roundabout retained); and
- The A36 (Shane's Hill Road) and B100 (Ballyrickard Road) junction.

Five grade separated junctions;

- The B95 (Green Road/Calhame Road) junction;
- The A57 (Templepatrick Road) junction;
- The Ballybracken Road junction;
- The Moss Road junction; and
- A new junction connection to the Deerpark Road.

In addition, the scheme would include a further bridge taking the existing Lismenary Road over, the new dual carriageway. Church Road would be stopped up to the west of Ballynure and a new link road constructed on the west of the new dual carriageway connecting Church Road to the A57 (Templepatrick Road).

To improve safety there would be no at-grade cross-over facilities and a central reserve barrier would run along the full length of the scheme. Wherever possible, private accesses and minor side roads would be diverted either onto adjacent side roads or to one of the key junctions. However, where not possible left-in left-out junctions onto the A8 would be provided.

The scheme would include four lay-bys, two in each direction, and there would be bus stops provided in the vicinity of the key junctions. A continuous footway/cycleway would be provided along the eastern side of the scheme, except for on the Ballynure bypass where the footway/cycleway would be connected to existing provision along the current A8 through Ballynure. Intermittent footways would be provided on the western verge to connect clusters of properties to crossing points and bus-stops at junctions.

5.5 Details of the Proposed Scheme

The proposed scheme would start at the existing Coleman's Corner roundabout, at the junction with the B95 Hillhead Road and Carntall Road.

Coleman's Corner Roundabout

The existing Coleman's Corner Roundabout would be retained, although there would be minor alterations to the kerb lines on the approaches to the roundabout and white lining changes to increase the capacity of the roundabout.

North of the roundabout the scheme would move off-line to the east of the existing A8, crossing the Ballylinny Burn (Ch0+670) before intersecting with Lisglass Road (Ch0+830). At this point there would be left-in left-out junctions between both sections of the Lisglass Road and the new dual carriageway. The scheme crosses the Lisglass Road approximately 125m to the east of the A8 and crosses the site of a proposed replacement dwelling for No. 6 Lisglass Road.

The scheme would then continue around the east of Bruslee, remaining relatively tight (between 20m and 50m) to the back of the properties on the east of the existing A8. The dual carriageway would then rejoin the existing A8 to the north of the Glen Road junction, immediately prior to two residential properties at approximately Ch1+640 (No. 68 and 70 Belfast Road).

Bruslee and Glen Road

The existing A8 through Bruslee would be retained to serve local properties and businesses. A new one-way link road connecting the existing A8 to the B95 (Hillhead Road) would be constructed to accommodate vehicles from Bruslee destined for the A8 south, and the existing Glen Road would be connected to the existing A8 catering for those vehicles using Glen Road.

Continuing north from Glen Road, the scheme would be online widening along the western side of the existing A8. The scheme would cross the Ballymena Burn and two of its tributaries before connecting with Drumadowney Road via a new left-in left-out junction (Ch2+080), and then reaching Calhame Road (Ch2+700).

Green Road, Calhame Road and Legaloy Road Junction

The new B95 (Calhame Road and Green Road) and Legaloy Road junction would be a compact grade separated junction, with a new bridge over the dual carriageway, constructed approximately 40m south of the existing Legaloy Road junction. A new roundabout would be provided on the east of the dual carriageway connecting the Legaloy Road, the realigned Green Road and the link to Calhame Road. In addition, a new link road connecting Rushvale Road and Calhame Road would be constructed.

Continuing north from the junction, the scheme would continue along the line of the existing A8 for another 1.1km, widening to the west, before moving off-line to the west to bypass Ballynure (Ch4+200). At this point the scheme would require the demolition of two agricultural buildings situated to the west of the existing road (associated with No. 31 Belfast Road). The route would then cross agricultural land, before intersecting with the A57 (Templepatrick Road) approximately 190m to the west of the existing A8/A57 roundabout.

A57 Templepatrick Road Junction

A full grade separated junction would be provided at the A57 (Templepatrick Road). The existing A8/A57 roundabout would be retained with slip roads provided to the south of the roundabout to cater for the southbound A8 traffic leaving and joining the dual carriageway. A new roundabout would be constructed approximately 400m to the west of the existing roundabout, with slip roads to the south to cater for the northbound A8 traffic. A new road linking the two roundabouts would be constructed slightly to the north of the existing A57. In addition, a new access road would be provided alongside the southbound slip roads. The northbound carriageway slip roads would require the demolition of two agricultural buildings and a residential dwelling (No. 10 Templepatrick Road) on the A57 to the west of the proposed dual carriageway.

From the proposed A57 (Templepatrick Road) junction the scheme would pass into the Six Mile Water valley, crossing the Ballynure Water at approximately Ch 5+540, at the point where Church Road crosses the watercourse. A new link road would be constructed to the west of the new dual carriageway connecting Church Road and the A57 Templepatrick Road. To the east, Church road would be stopped-up to accommodate the bypass. Access to the eastern section of Church Road from Ballynure would be retained. The scheme then continues around the village across agricultural land passing to the west of a farm off Church Road (No. 21 Church Road).

Continuing north, the scheme crosses more agricultural land before intersecting with Lismenary Road on the edge of Ballynure approximately halfway between No. 19a and No. 21 Lismenary Road. Lismenary Road would be bridged over the new dual carriageway with no connection provided between the two roads.

North of Lismenary Road the scheme would continue across agricultural land crossing two farm accesses (No. 24 and 32 Larne Road) before rejoining the existing A8 in the vicinity of the Ballybracken Road junction. The farm access for No. 24 Larne Road would be retained via a new bridge over the dual carriageway.

Ballybracken Road Junction

A new compact grade separated junction would be provided between the new dual carriageway, the Ballybracken Road and the existing A8 carriageway at this point, providing access to the new dual carriageway to and from Larne only. A new underpass, taking the junction link road beneath the dual carriageway, would be constructed approximately 30m south of the existing Ballybracken Road junction. The junction also includes a parallel road connecting the original A8 to Ballybracken Road.

North of the Ballybracken Road the scheme initially widens to the east of the existing A8, before switching to the west between Ballybracken Road and Junction Lane, and then switching back to the east before reaching the Old Larne Road. Access to Junction Lane and Old Larne Road are retained through left-in left-out junctions. The scheme then reaches the existing southern junction with the Ballygowan Road which would be closed with no vehicular access.

Continuing north, the scheme moves back across the existing A8 corridor to the west before reaching Moss Road at Ch10+070. A further residential property located on the corner of the existing A8 and Moss Road would be demolished (No. 78 Larne Road).

Moss Road Junction

A new compact grade separated junction would be provided at Moss Road. The junction would include a new bridge over the dual carriageway approximately 100m north of the existing junction with Moss Road to the east of the A8. The connecting roads linking Moss Road to the dual carriageway would be to the south of the bridge, and a new junction with Ballygowan Road would be formed approximately 100m north of the existing junction. The scheme would include improvements to Ballygowan Road, and the priority of Moss Road/Ballygowan Road switched.

Beyond Moss Road junction the scheme would continue widening to the west, and require the demolition of a further derelict building (at approximately Ch10+220, No. 84 Larne Road) and another residential dwelling (at approximately Ch10+550, No. 92 Larne Road), before reaching the existing Deerpark Road/Ballygowan Road junction. Access from these side roads to the A8 would be removed and the side road junctions closed.

North of Deerpark Road, the scheme moves off-line to the east of the existing alignment before passing a cluster of properties located on the west of the A8 opposite the Loughside Quarry.

Deerpark Road Junction

At this point a new compact grade separated junction would be provided with a link road connecting it to the Deerpark Road. The junction would include a bridge over the new dual carriageway, located approximately 100m north of the properties, with the existing A8 retained for access.

The scheme would then move back online, widening to the east, before crossing the Larne River twice within 400m (at approximately Ch12+570 and Ch12+890) and reaching the existing junction with Park Road which would be closed. The final 1.5km of the scheme involves widening slightly on both sides of the existing A8, with the dual carriageway passing between the Lowtown Rath and Souterrain and the buildings opposite at approximately Ch13+600.

A36 Shane's Hill Road and B100 Ballyrickard Road Junction

A new roundabout would be provided midway between the existing B100 (Ballyrickard Road) and A36 (Shane's Hill Road) junctions. Both these side roads would be connected into the roundabout, with the severed sections of road retained to provide access to land and residential properties.

5.5.1 Footways and Public Transport

Footways and Public Transport

The number of bus stops along this section of the A8 would be rationalised with the new scheme. Bus stops will be provided at key junctions, which are to be lit, enabling safe pedestrian crossing of the new dual carriageway.

A minimum 2.0m wide shared footway/cycleway would be provided along the eastern verge of the mainline, with the exception of the Ballynure bypass where the shared use footway/cycleway would connect to the existing provision through the village. Additional sections of intermittent 1.5m (minimum) wide footway would be provided along the western verge to connect isolated properties to the nearest junction.

5.5.2 Drainage

The main features of the scheme drainage design are described below.

Surface Water and Subsoil Drainage

The preliminary design includes a positive surface water drainage system (channels, kerb and gullies, or combined kerb drainage units) for the mainline and side roads. The road surface water drainage will be attenuated where required, and petrol interceptors provided at every outfall, to maintain the quality of the watercourses being discharge into. The sub soil drainage will be via narrow filter or fin drains, and will outfall to the associated rivers and watercourse with no treatment or attenuation.

Cross Drainage

Cross drainage culverts would be provided at the majority of the existing watercourse crossings with the remainder of the watercourses diverted to connect to other existing watercourses. Fish beds and otter ledges would be provided where appropriate. The culverts will typically be constructed slightly off-line of the existing watercourse and then the watercourse connected to the completed works to minimise the risk of pollution during the works.

Cutting and Embankment Drainage

Cutting and embankment drainage in the form of ditches and filter drains would typically be provided wherever the adjacent topography falls towards the scheme with outfall either into the highway drainage or the adjacent cross drainage culverts.

Flooding

A number of the existing culverts beneath the existing A8 constrict the flow of flood under associated with a 1:100 flood event[16]. To ensure the upgrade of the culverts does not result in other properties downstream being flooded as a result of changing this situation, ponds and flow constriction measures will be provided to manage and restrict the flow of the 1:100 flood and replicate the existing arrangements.

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[16] 1:100 year flood – Is calculated to be the flow water expected to be equalled or exceeded every 100 years on average.

5.5.3 Lighting

The preliminary design includes road lighting for all the major junctions and roundabouts with standard columns. The lighting would extend beyond the approaches to all the compact grade separated junctions and on the approaches to and exits from the priority junctions within them. The lighting at Coleman's Corner roundabout will be improved, and lighting will be provided on each approach and exit from the new A36 (Shane's Hill Road) and B100 (Ballyrickard Road) roundabout.

5.5.4 Signage

The scheme traffic signs would consist of junction Advance Direction and Local Direction signs (ADS and LDS) as well as standard warning and regulatory signs. The ADS and LDS signs would be unlit whereas the standard signs would vary depending on the nature and type of sign.

5.6 Construction Methods and Programme

5.6.1 Introduction

This section outlines the main construction activities that are expected to take place during decommissioning and construction of old and new sections of the A8. The purpose of this section is to provide an overview of the construction activities and an understanding of the timescales involved with the construction process and phasing. It also provides details for the assessment of the construction phase.

Construction impacts are considered in the ES as these impacts can often be more significant than those during the operational phase and as such need to be given due consideration and attention. The construction impacts are assessed in each technical chapter, as presented in Part II of this ES.

For the purpose of the ES, basic assumptions on construction activities have been formulated based on discussions with the IDT Contractor. At this stage these methods are considered the most appropriate approach to the scheme, however they may be subject to change or further development during the Design and Build (D&B) phase of the scheme.

5.6.2 Programme

Overall Programme

The A8 Dualling scheme is identified within the Investment Delivery Plan for Roads (IDP) to be delivered between 2013/14 to 2017/18. For the purpose of this ES the scheme Opening and Design Years have been taken as 2016 and 2031 respectively.

Construction

The construction programme would be finalised by the main contractor in advance of the works. The duration of the works is currently estimated to require a construction period of approximately 21 months with 3-4 months advance works/utility diversions, archaeological testing etc and approximately 5 months of inspections and handover on completion of the scheme. However, depending on the final earthworks strategy this could increase or reduce slightly.

The delivery of the scheme has been considered in three sections as detailed in Table 7.

Table 7 **Scheme Delivery Sections**

Section	Chainage Location	Description
Section 1	Ch0+000 to Ch4+400	Bruslee bypass and online to Ballynure
Section 2	Ch4+400 to Ch7+650	Ballynure Bypass
Section 3	Ch7+650 to Ch14+400	Ballybracken Road to Ballyrickard Road (end of scheme)

5.6.3 Key Construction Activities

Advance/Preparatory Works

The existing A8 provides a service corridor for BT, Northern Ireland Electric and Northern Ireland Water networks. In addition there are a number of major services that cross the scheme immediately north of Ballynure, including overhead electricity lines, a water-main and high pressure gas transmission pipeline. During the early phases of the construction works, and potentially before any major construction works the diversion of the various utilities would be undertaken.

Archaeological Pre-development Testing

Advanced archaeological testing would be undertaken in the early stages of the project, through a supervised topsoil strip or trial trenching. A key programme constraint is the availability of fill material for the scheme, especially the online sections, and therefore the Ballynure bypass which provides the main source of site won material would be cleared first.

Site Clearance

The initial activities following site establishment would be fencing, site clearance, the installation of pre-earthworks drainage and topsoil strip under archaeological supervision.

Earthworks

Following the topsoil strip the major earthworks can begin. The majority of the fill material required for the online sections (Sections 1 and 3) is generated from the cuttings along Section 2 (Ballynure Bypass). Therefore the key programme driver would be rock excavation, processing and transfer of Class 1 material from Section 2 to Section 3. The cuttings within Section 2 would also generate a significant volume of Glacial Till material, some of this material could be too wet on excavation to immediately place as structural fill and it is therefore likely that it would require some form of lime stabilisation to treat material before placing may be required to form the embankments.

Drainage

Pollution prevention measures would be implemented to ensure that land and rivers are not contaminated. Silt pollution of the tributaries leading to the Six Mile Water will be a key concern. A Water Management Plan would be developed and temporary settlement ponds would be designed into the works and installed before the bulk earthworks were undertaken. Where possible the permanent drainage attenuation ponds would be installed early and used in the construction phase.

Structures

The structures for the scheme fall into a series of categories; new structures at grade separated junctions, new road and accommodation overbridges, replacement structures for existing bridges and culverts along the A8 route. The form of structures is generally precast concrete beams with an in situ concrete deck.

The new side road structures are generally being constructed off-line of the existing side roads, therefore allowing traffic flows on the side roads to be maintained. There are three structures across the new dual carriageway which also crosses the existing A8. The construction of these bridges would be phased to maintain traffic flow along the A8.

The preferred method for building the replacement watercourse structures is to construct the new structure adjacent to the watercourse to minimise the disturbance to the river bed during construction. The watercourse would then be diverted through the new structure before demolishing the existing structure.

5.6.4 Construction Equipment and Key Areas

Compounds

The location of the main construction compound has not been finalised but it is currently envisaged it would be at the southern end of the scheme, either near the Coleman's Corner roundabout or in the vicinity of the B95 Green Road/Calhame Road junction. Satellite compounds would be located throughout the length of the scheme, generally in the location of new structures. Site compounds would be lit at night for security purposes.

Stockpile areas for topsoil would be located at approximately 1km intervals along the scheme.

Working Hours

The working day would vary between the seasons. However, it would typically be 7am to 7pm in the summer months and 7.30am to 5.30pm in the winter. Weekend or night work would be required for any works that require lane closures (e.g. pipe crossings, traffic management switches, etc) on the main routes of the A8 or A57.

Construction Plant and Equipment

The site clearance phase of the works is likely to involve chainsaws and excavators. The bulk earthworks would be constructed using articulated dump trucks, excavators up to 65T capacity, rock drilling and blasting equipment, dozers and rollers. The new structures would be constructed using cranes, telescopic boom lifts, piling rigs and telescopic forklifts. Task lighting at structure locations during the winter months only, and other locations where required, would also be provided.

5.6.5 Traffic Management

Traffic Management Strategy

The existing A8 road carries significant volumes of vehicles throughout the day and night, and there are a high number of junctions with several of these being key junctions to the route.

A series of key traffic management measures would be implemented including:

- One lane of traffic in each direction maintained during peak periods. Works that require lane closures would be coordinated as much as possible such that they are at off-peak times or weekends;
- Speed restriction in work areas for the safety of road users and the construction workforce. These restrictions would only be introduced when the works commence and would remain until a specific section was complete;
- Phased closure/restriction of access to side roads as new replacement junctions are completed; and

Construction Routes and Workforce Movements

The site is mainly along the line of the existing A8 which would therefore serve as the main access. However, for the Ballynure bypass section, access would be available via the A57, Church Road, Lismenary Road and opposite Ballybracken Road.

It is envisaged that the scheme could generate up to approximately 200 workforce trips to and from the site per day, and approximately 400 construction vehicle trips per day. However, these would be via a number of different routes and would be spread across the surrounding road network.

5.7 Changes to the Scheme Design

Following the publication of the preferred route in August 2009 the design of the scheme has been developed and refined further to reduce the impact of the scheme on the environment and local landowners, and deliver a more cost effective solution for parts or elements of the scheme. It has also considered initial input from members of the public, local landowners and residents. The key changes that have been made between the proposed scheme and preliminary scheme design are:

Hillhead Road Link

Following a more detailed assessment of the layout of the proposed Hillhead Road link, which highlighted concerns regarding traffic exiting Coleman's Corner roundabout, the proposed link has been amended to a one-way link from Bruslee to Hillhead Road. Traffic wishing to access Bruslee is catered for through the new dual carriageway and Lisglass Road junction.

Rushvale Road Link

Following comments from a number of local residents regarding the length of diversions the level of access provided for Rushvale Road was reviewed. A number of options were considered to reduce the level of diversions including a new overbridge connecting Rushvale Road and Drumadowney Road, and a new link road from Rushvale Road to Calhame Road. The primary differential between the options was the cost and environmental impact, which resulted in the incorporation of a link to Calhame Road.

A57 Templepatrick Road Junction

The review of the earthworks strategy for the scheme highlighted potential benefits through amending the layout of the A57 Templepatrick Road junction layout to reduce the amount of fill material required for the proposed embankments. Further discussions were also held with local landowners and residents regarding the options for this junction. Following the review a revised junction layout was adopted that relocated the northbound carriageway slip roads to the south of the A57 (Templepatrick Road).

Ballynure Bypass Alignment

The changes to the A57 Templepatrick Road junction, and more specifically the A8 alignment through the junction, provided opportunities to adjust the alignment of the dual carriageway around Ballynure. Further discussions were held with local landowners regarding the options available, and the route was adjusted slightly to reduce the impact on a residential property on Church Road.

Church Road Closure

A review of the proposed layout for Church Road highlighted an opportunity to reduce the cost of the scheme and the visual impact of the dual carriageway by closing Church Road and constructing a new link road to the A57 Templepatrick Road. The proposed change reduces the size of the structure required at the point where the scheme crosses the Ballynure Water and the existing Church Road.

Ballybracken Road Junction

The review of the earthworks strategy for the scheme highlighted a deficit of material. The Stage 3 assessment considered a number of different strategies to reduce this deficit and therefore reduce the cost and environmental impact of the scheme. This review highlighted the opportunity to change the proposed Ballybracken Road over bridge to an underpass therefore generating more material and reducing the deficit. In addition, the change in the junction layout reduced the visual impact of the junction while maintaining a similar land requirement. The more detailed traffic modelling has also demonstrated there is little forecast usage of the south facing slip roads and therefore these have been removed from the proposed junction.

Moss Road Junction

The proposed layout of the Moss Road junction has been amendment to relocate the bridge to the north of the existing junction, with the proposed slip roads to the south of the bridge. The revised layout significantly reduces the fill material required to construct the scheme and therefore reduces the visual impact of the junction. In addition, the Stage 1 Road Safety Audit highlighted concerns regarding the existing Moss Road/Ballygowan Road junction. The subsequent review of the options available to address the concerns resulted in the implementation of a revised layout that realigned the Moss Road connection to Ballygowan Road, and upgraded a section of Ballygowan Road.

5.8 Code of Construction Practice

5.8.1 Purpose

The purpose of this section of the ES is to set out the minimum standards to be adopted during the construction of the A8 Belfast to Larne Dual Carriageway ('A8 Dualling Scheme') in order to prevent or reduce potential environmental effects associated with construction activities.

This CoCP has informed the assessments within this ES in order to demonstrate the intended approach to environmental management during the construction phase. For the purposes of assessing likely significant environmental effects of the construction phase of the scheme, it is assumed that the measures set out in this CoCP are adopted (i.e. they form part of the scheme that is assessed).

This CoCP should inform the Construction Strategy which describes all main aspects of the proposed construction works, how construction would be undertaken and the programme for construction of the A8 Dualling scheme. It is assumed that the contractor and Roads Service will provide a sufficient level of environmental supervision to monitor the construction works.

5.8.2 Legislation and Guidance

Legislation and construction good practice change over time. This CoCP has been written with regard to guidance and legislation of relevance at the time of writing.

The main Contractor will be responsible for identifying and complying with legal and other requirements applicable to their scope of works to design and construct the scheme.

References to guidance documents used in the development of this CoCP and relevant to construction activities are provided below. These provide the context in which the recommended environmental measures and monitoring requirements are set. These guidance documents should be referred to for further information where required.

Overall, construction should be carried out in accordance with guidance outlined within Construction Industry Research and Information Association (CIRIA) best practice guidance and the Environment Agency (EA), Scottish Environment Protection Agency (SEPA) and NIEA's Pollution Prevention Guidelines (PPGs). All PPG documents are available to view and download via the NetRegs website (http://www.netregs.gov.uk/netregs/links/107968.aspx).

5.8.3 Environmental Management Measures

As part of the contractor's team, a competent member of staff would be assigned the role of environmental manager for the scheme. This role would involve developing and maintaining the environmental management system for the scheme. The environmental manager would be required to be present at key meetings, where construction activities have a potential environmental issue. The environmental manger would be responsible for ensuring that appropriate specialists (ecologist, archaeologist) are on site as and when required.

On site, a competent member of the contractor's team, would be the environmental site representative, responsible for ensuring that the measures outlined in the CoCP are adhered and the first point of call for any environmental incidents and should liaise directly with the environmental manager.

5.8.3.1 Nature Conservation

General Measures

- All ecologically sensitive features which are to be retained will be fenced off and clearly signed prior to site clearance allowing for any agreed undisturbed buffer zones. BS1722 British Standard for Fencing will be applied to fencing installed around trees and shrubs to safeguard the root zone to protect from accidental damage;
- Care during the set-up of the construction site to avoid siting particularly noisy (for example generators) or busy (for example stores) works areas near to sensitive ecological receptors;
- Adherence to PPGs and other controls as agreed with NIEA prior to construction to prevent pollution to watercourses;
- A method statement would be agreed with DCAL and Rivers Agency for the realignment of the watercourses to avoid adverse effects occurring in relation to fisheries. The appropriate consents would be applied for from Rivers Agency, DCAL and NIEA;
- Dust abatement measures, such as damping, to prevent deposition on vegetation communities alongside works;
- Open excavations will be fenced overnight in accordance with Health and Safety procedures. A safe means of escape, such as a sloping plank should be provided to allow mammals to extricate themselves from the excavation;
- Information for best practice relating to wildlife would be given through tool box talks by a qualified ecologist;
- A watching brief would be maintained at critical construction times at ecologically sensitive areas. The watching brief would be undertaken by an appropriately qualified ecologist to ensure opportunities for minimising effects on features of ecological importance are taken wherever possible. This would include obtaining and implementing the terms and conditions of any licences for protected species where required, and searches for protected species in affected areas of habitat that are considered suitable. Vegetation clearance would be subject to watching brief such that protected species would not be affected. Measures to be undertaken in the event of the unforeseen discovery of a protected species would be agreed with the relevant statutory agencies;
- Where construction activities are adjacent to areas of nature conservation value[17], these will be fenced to prevent ingress of people, machines or

17 Areas of nature conservation value include designated / registered sites as well as those sites which are identified within the ES as being important.

materials into these protected areas if permanent construction boundary fencing is not in place;

- Where possible compounds and work areas will not be located within 10m of areas of nature conservation value and surface streams. Where this is unavoidable specific measures will be put in place to protect the nature conservation interest in accordance with relevant guidance;
- Any soil removed for re-use in ecological mitigation will be carefully sorted and stored into subsoil and topsoil stockpiles to avoid mixing and/or compaction;
- If protected species are discovered during construction, works in the affected area will stop and the advice of a suitably experienced ecologist will be sought. Works will only recommence following this advice. For some protected species, there may be a requirement to apply for a licence for works that may disturb them; and
- Lighting will be positioned and directed to minimise intrusion and disturbance of river corridors and other areas of nature conservation value.

Birds

Where the construction programme allows, measures will be taken to clear trees, scrub and tall herbaceous vegetation outside the bird-breeding season (i.e. between October and February). Where clearance works cannot be avoided during the nesting season, a survey will be undertaken by a suitably competent person prior to clearance to ensure the area does not contain active nests. If nesting birds are located, a buffer zone of existing vegetation around the nest will be designed and introduced in consultation with a competent and suitably experienced ecologist before the relevant works proceed.

Bats

- Pre-construction checks on all trees/buildings to be removed would be required, to ensure that no bats are occupying these structures. If any bats are found to be present at this stage, a licence would be required from NIEA before demolition and construction can commence;
- Destruction of roosts will not occur during the period in which bats are occupying that roost. Mitigation in the form of alternative roost sites would need to be provided prior to destroying existing roosts under a licence from NIEA;
- Construction works for the A57 junction will be timed to avoid the period while bats are present in the adjacent bat roost. The bats are likely to be present during the summer (April-October) but this will need to be confirmed by a bat specialist in advance of the works;
- Construction activities (such as earthworks, surfacing etc) would be restricted to daylight hours in areas in close proximity to the River Larne and Ballynure Water crossings in order to limit disturbance to bats and otters, which are mainly active between dusk and dawn; and
- Temporary measures such as poles with tape/ribbon along lines of maintained crossings and where bat hop-over planting is proposed should be installed immediately following vegetation clearance (as advised by the Environmental Manager) to maintain bat flight lines.

Badgers

Works within 30m of an active badger sett will require a licence from the NIEA. In cases where direct loss of badger setts is unavoidable, the sett will be closed down under licence from the NIEA Wildlife Officer and animals relocated to alternative, artificial sett sites.

Otters

- A licence would be required from NIEA before construction can be undertaken as there are potential otter holts in the area which are likely to be disturbed. As part of the licence application a mitigation strategy is required. It is recommended that the site be resurveyed immediately prior to construction commencing to ensure that new lying-up sites or holts have not been created by otters;
- Construction near watercourses would be restricted to daylight hours in order to limit disturbance to otter movement, which mainly occurs between dusk and dawn;
- Safe means of passage for otters to cross the construction site without the risk of being hit by construction plant should be maintained. This may require temporary fencing in additional locations to those where permanent fencing is required. Locations to be agreed by the environmental manager or ecologist;
- Watercourses must not be completely blocked during the construction phase and should remain passable to otters at all times.

Fisheries

To mitigate the impact of construction on fish populations during the construction phase, a method statement would be prepared and agreed with DCAL for works to realign any watercourse within the scheme assessment area. This would specify measures to protect fish, including the following:

- Works to be carried out at the driest time of the year (usually April to July) and should not be carried out during the autumn or winter months. This would minimise any possible impact on fish spawning activities;
- The realignments should be done as much as possible within dry channels to prevent sediment being introduced to the river;
- The banks of any new sections of river channel should be adequately protected to enable plant growth to establish before the water is introduced and reduce the potential for soil to be washed from the bank if there is a flood;
- Dewatering of the old section of river should be completed in a manner which would ensure that any fish are removed and returned unharmed to the river. A competent person should be employed to do this and would need a permit issued by DCAL for the purpose; and
- Works must be carried out in a manner which would ensure the free passage of fish at all times through the affected reach.

Woodland, Grassland and Hedgerows

Unless otherwise allocated within the ecological translocation programme, cut timber will be utilised in accordance with the Site Waste Management Plan. If it is not possible to utilise the timber, discrete log piles should be left as dead wood habitat.

Veteran Trees and Tree Preservation Orders (TPOs)

- TPOs within the scheme assessment area are currently subject to an arboricultural assessment. Appropriate guidance will be added subject to the findings of the assessment.
- Any veteran trees to be felled must be clearly identified in advance of felling and felled under supervision of a competent and suitably experienced ecologist.

Watercourses

Watercourses to be diverted or lost will first have fish; aquatic invertebrates, plant species (and substrate if appropriate) relocated to suitable receptor sites prior to stopping off water supply.

Japanese Knotweed

Disturbance of soils within 7m of any Japanese knotweed will require a Japanese Knotweed Management Plan to be prepared detailing how any Japanese knotweed contaminated soils will be dealt with. It is recommended that this species be treated according to the Environment Agency (EA) UK guidance 'Managing Japanese knotweed on development sites: the knotweed code of practice'.

The method statement will be submitted and agreed with the NIEA to ensure the most effective control and disposal of Japanese Knotweed material. Methods that will be considered include:

- Cutting, drying and composting stem material if suitable locations on-site exist;
- Treatment using herbicide from July to September over three growing periods;
- Digging plants in winter and treating re-growth in spring and summer;
- Digging and stockpiling material on-site with subsequent re-treatment of growth;
- On-site burial at depth of 5m; and
- Off-site disposal.

Treatment typically involves spraying the plants with glyphosate every year for a minimum of 3-5 years. If any areas of Japanese Knotweed require removal, any soil material within a 7m radius of the base of each stand must be disposed of at a licensed waste landfill site in accordance with the EA guidelines.

Monitoring

Ecological monitoring will be undertaken by suitably experienced and competent ecologists during the construction period and an ecological monitoring programme will be agreed with the NIEA (and other relevant bodies) prior to the commencement of construction activities.

Relevant Guidance

Environment Agency Managing Japanese Knotweed on Development Sites;

Wildlife Conservation Research Unit/Highways Agency publication Nature Conservation and Roads: Advice in relation to otters;

BS 1722:2006 British Standard for Fencing;

Planning Policy Statement 2: Planning and Nature Conservation;

BS 5837:2005 Trees in Relation to Construction;

Badgers and Development (NIEA, 2005); and

Bats and Development (NIEA, 2008).

5.8.3.2 Cultural Heritage

Site Investigation Works

Site investigation measures as outlined in the Chapter 9 of the ES and detailed within a written Scheme of Investigation shall be submitted to and approved by NIEA, will be complied with during construction.

General Measures

- Detailed archaeological testing methodologies will be designed, implemented and monitored to ensure that the cultural heritage resources are protected from damage from construction activities;
- Screening will be erected, compatible with the type of works being undertaken, around historic buildings or archaeological areas located within, or adjacent to, a working site or access route to ensure their protection during construction;
- Procedures will be put in place to protect and preserve archaeological remains encountered unexpectedly during the construction works; and
- Condition surveys will be undertaken to define vibration limits for the protection of cultural heritage resources remaining *in situ* that are susceptible to damage by vibration from construction works.

Cultural Heritage Finds

Any archaeological finds must be reported to the NIEA or Ulster Museum within 14 days of discovery and details provided of where and how the object was found.

Monitoring

A cultural heritage watching brief undertaken by a qualified archaeologist, will be developed and implemented for the duration of relevant construction works (i.e. excavations, earthworks. This would require approval by the NIEA prior to the construction works;

Relevant Guidance

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

Planning Policy Statement 6: Planning, Archaeology and The Built Heritage.

5.8.3.3 Landscape

Lighting

- Where appropriate, lighting will be provided at site boundaries with illumination sufficient for the safety of the passing public. Precautions will be taken to avoid shadows cast by site hoarding on surrounding, roads, footpaths and amenity areas;
- Lighting will be positioned and directed so as not to unnecessarily intrude on adjacent buildings and land uses and prevent any unnecessary interference with local residents and passing motorists. This will particularly apply to sites where night working is undertaken; and
- BS 5489 Parts 1 and 9 (Road Lighting) and Institute of Lighting Engineers guidance notes for reduction of light pollution will be complied with.

Hoarding and Fencing

- Appropriate fencing would be used to secure the construction fence-line and protect the public from construction activities;
- Suitable measures will be used for tree protection;
- Existing walls, fences, hedges and earth banks will be retained where possible; and
- Hoarding will be maintained in good condition.

5.8.3.4 Geology and Soils

General Measures

- A contamination watching brief will be designed and implemented during construction to ensure that any significant contamination not identified during the investigations is recorded and can be dealt with appropriately;
- Made ground material identified as unsuitable in chapter 11 is not to be re-used in the construction works without further investigation and / or sorting to remove inappropriate material;
- Potentially polluting materials may be used during construction, including fuels and oils and potentially other liquid chemicals. Standard good housekeeping procedures and environmental control measures should be adopted for the management and mitigation of risks;
- Where ground with significant levels of contamination (as defined in the ES) is encountered during construction, working methods and procedures will be employed to minimise adverse impacts to human health and the environment.
- Any local pockets of potentially contaminated soil encountered during the works should be assessed and if required the material disposed of at a licensed waste facility;
- Ground workers and other staff potentially at risk should be made aware of potential site hazards via site safety induction procedures and appropriate Personal Protective Equipment (PPE) should be worn;
- Fuels and other potentially contaminated liquids should be stored in sealed and bunded enclosures. All such liquids and soluble solids should be managed

with appropriate care. Accidental spills should be contained and absorbed, for example using straw bales and/or spill management kits;

- Appropriate control measures should be adopted to prevent and control leaks and spills from entering the sub-surface or groundwater environment;
- Construction work would involve excavation and removal of glacial deposits at most cutting locations along the route and the removal of basalt bedrock in some locations. Material removed as part of the construction should be re-used elsewhere in the scheme where practicable and possible;
- Topsoil and subsoil should be separated where removal is required and this should be conserved and stored in a designated area and appropriately protected, ready for re-use as landscape fill for the scheme;
- During the construction phase, site management should implement a waste minimising strategy to avoid unnecessary creation of waste;
- Where contamination is encountered, the site will be divided by internal fencing into 'clean' and 'dirty' (contaminated) work areas;
- Contaminated materials encountered will be assessed using the following criteria (applicable for solids, liquids, gas and leachate) to identify their appropriate management:
  - Capacity for re-use, either on or off-site;
  - Potential hazard and appropriate health and safety measures to minimise this hazard;
- Measures will be implemented to prevent the contamination of ground and surface watercourses and aquifers during the works as detailed in the Road Drainage and the Water Environment chapter (see chapter 12);
- Measures will be implemented to prevent the emission of hazardous dusts during excavation, or from stockpiles as detailed in the Air Quality section; and
- Where contaminated materials are to be removed from the construction site they will be stored separately from clean materials and controls put in place to prevent contaminants leaching into the ground or surface waters and to prevent the spread of contaminated dust.

Demolition Control Measures

- Measures, including fencing and/or screening, will be implemented to ensure that demolition debris is kept within a controlled area, in order that the area of ground potentially affected by demolition works is kept to a minimum; and
- All structures will be surveyed for the presence of asbestos before demolition. Asbestos will be removed by a specialist contractor and disposed of in accordance with the relevant legislation.

Lime/Cement Stabilisation

- In areas where lime or cement stabilisation is being carried out all personnel will use appropriate PPE;
- Lime and cement will be stored in a cool dry environment free from draughts, away from water and flammable materials. Bulk storage will be contained in a purpose-built silo; and

- Detailed advance briefings on the hazards and procedures associated with lime and cement stabilisation as well as on methods to prevent hazardous dust emissions will be provided prior to stabilisation taking place. Specific measures to be taken to minimise dust are detailed in DMRB Volume 4, Section 1, Part 6, HA 74/07 'Treatment of Fill and Capping Materials Using Either Lime or Cement or Both', and apply to the handling of lime and cement.

5.8.3.5 Road Drainage and the Water Environment

Consents

- Where water is to be abstracted from surface water or groundwater a licence will be obtained from the NIEA and/or Rivers Agency. Where discharges are required to controlled waters or sewers, consent will be obtained from the NIEA/Rivers Agency or the statutory sewerage undertaker as applicable. De-watering operations will also require registration and/or a permit and this will be obtained from the NIEA/Rivers Agency; and
- Works in, over or under a watercourse or works altering or repairing any structure in, over or under a watercourse, and works within the drainage margin of the watercourse will require consent from the NIEA/Rivers Agency/DCAL.

Site Drainage

- Site drainage plans will be submitted to the NIEA for approval prior to the commencement of works.

Pollution Control

- All potentially polluting substances will be stored on impermeable surfaces with controlled drainage, away from storm water sewers, grids, channels, watercourses and ditches. Otherwise adequate measures must be taken to protect against pollution;
- All fuel, chemicals and oils will be stored within bunded areas in accordance with PPG26 and PPG2;
- All tank discharge pipes, valves and trigger guns will be contained securely within the bund when not in use;
- Bowsers will be stored within secure areas when not in use to protect from theft and vandalism;
- Leaking or empty oil drums will be removed from site immediately and disposed of via an appropriately licensed waste disposal contractor;
- All hazardous substances on-site will be controlled in accordance with The Control of Substances Hazardous to Health Regulations (Northern Ireland) 2003 (COSHH Regulations). The storage compound will be fenced off and locked when not in use to prevent theft and vandalism;
- Refuelling of plant and machinery will take place at least 10m away from watercourses using a mobile fuel boswer and spill kits to reduce risk of spillages entering the sub-surface or groundwater environment. Only double bunded fuel bowsers will be used. Vehicles will not be left unattended during refuelling operations;

- All water runoff from designated refuelling areas will be channelled to an oil separator or an alternative treatment system prior to discharge;
- Fuel storage tanks will be locked when not in use to prevent unauthorised access and reduce the risk of vandalism;
- Wheel washing will be undertaken in a designated area. Water from wheel washing facilities and wash down areas will be recycled or fully contained and disposed of via tankers or through connection with the foul sewer (in accordance with relevant consent from the sewerage undertaker);
- Concrete mixing should be undertaken in designated impermeable areas at least 10m away from a watercourse or surface water drain to reduce the risk of run-off entering a watercourse or the sub-surface or groundwater environment;
- Equipment, batching and ready mix lorry washing and cleaning should be washed out on site into a designated area that has been designed to contain wet concrete / wash waters (see PPG6); and
- Spill kits will be held on-site with a variety of absorbent materials to be used in the event of a spill of fuel, oil or chemicals. Given that the project is long and linear, spill kits will need to be provided at a number of sites to ensure that they are easily accessible and can be deployed within a very short period of time.

Protection of Surface Water

- A minimum of a 10m buffer will be maintained adjacent to surface watercourses (e.g. rivers, ponds) except where works are specifically required to the surface watercourses (e.g. culverting or diversion of watercourses and bridging of watercourses). This 10m buffer area will be fenced to prevent storage of materials, refuelling, vehicle traffic and similar activities;
- Where works are required in or adjacent to watercourses protection measures will be provided in accordance with the requirements of the NIEA.
- Approval from the NIEA, Rivers Agency and DCAL will be obtained for crossing of, diversions to and work within statutory buffer zones for watercourses;
- Equipment liable to float away and potentially polluting materials will not be stored within areas at significant risk of flooding. Fuel oils and other chemicals stored in bulk will be located no less than 10m from any watercourse; and
- Booms will be held on-site for works near a watercourse.

Managing Run Off and Silty Water

- Measures will be taken to ensure that run off from earthworks does not enter drains, watercourses or ditches; this may include the use of silt fences;
- Areas of exposed ground and stockpiles will be minimised to reduce silty runoff. Geotextiles will be used as necessary to shield spoil mounds;
- Provision will be made for settlement areas to deal with silty water. The settlement facility will be designed for the volume of water and suspended particles within it;
- Water that is unpolluted aside from its silt content may be pumped out over adjacent vegetated ground where the land is part of the site or permission has

been obtained from the landowner, providing the land is not contaminated or a site of wildlife importance. The water will be pumped at a rate that allows absorption into the ground without significant ponding, and the discharge point will be moved regularly to prevent significant ponding;

- Water, unpolluted other than with fairly coarse particles, and with relatively small flows, may be treated by passing through tanks or skips with a suitable filter such as gravel, geotextiles, straw bales or siltbusters; and
- Areas of hard standing and surface roads will be swept regularly to prevent the build up of material which could be washed into water courses.

Monitoring

- A water monitoring programme will be implemented;
- All discharges will be monitored in accordance with the consents held;
- Routine monitoring will be undertaken at watercourses upstream and downstream of the works and at all discharge points to measure for turbidity, odour and presence of oil film and to ensure they are free from litter and debris; and
- The use of water will be monitored during construction.

5.8.3.6 Noise

General Measures

Measures will be identified and employed to reduce noise and vibration arising from construction activities. Specific measures will include:

- Selection of construction method and programme to minimise noise and vibration at sensitive receptors;
- Selection of routes and programming for the transport of construction materials, spoil and personnel to minimise noise and vibration at sensitive receptors;
- Design and use of site hoardings and screens to provide acoustic screening where practicable at the earliest opportunity. Doors and gates will not be located opposite occupied noise-sensitive buildings;
- Minimisation of vehicles waiting or queuing on the public highway to access the site with engines running;
- Only plant conforming to relevant national or international standards, directives and recommendations on noise and vibration emissions will be used;
- Plant and equipment liable to create noise or vibration will be located away from sensitive receptors or will be controlled by the use of lined and sealed acoustic covers or enclosures to prevent or reduce risk of disturbance;
- Where used, acoustic covers or enclosures will remain in place whilst the relevant noise generating equipment is in use;
- Regular maintenance will be undertaken on all plant and equipment in accordance with manufacturers' guidelines. Maintenance records will be kept on-site;

- Exhaust silencers will be fitted to all plant, machinery and vehicles;
- Plant and equipment will be used where practicable in the mode of operation that minimises noise, and shut down when not in use;
- Vibration predictions will guide the selection of steps to minimise vibration and other activities where it is not practicable to minimise vibration at source. Operations for which vibration prediction is likely to be required include, but are not limited to:
  - Demolition;
  - Impact breakers;
  - Dynamic compaction;
  - Piling;
  - Vibratory compaction; and
  - Rock blasting.
- Unless otherwise agreed with relevant local authorities, vibration levels will be predicted in accordance with the methods set out in BS 5228: 1992: Part 4. Guidance in BS 6472, BS 5228 and BS 7385 will be used to establish criteria, controls and working methods. Control measures will be agreed with relevant local authorities.

Working Hours

- See chapter 5.6.4;
- For loading/unloading of lorries in main site compounds, working hours will be extended to 07:00-23:00 Monday-Friday, 07:00-16:00 Saturday and Sunday;
- Works extending outside normal hours will be undertaken in the following order of preference:
  - Evening periods;
  - During the daytime over the weekend;
  - Night working, which will be considered as a last resort or where the need is driven by other constraints;
  - Locations of works that are anticipated to be outside normal working hours will be defined and confirmed;
  - Where unforeseen circumstances result in works extending beyond working hours, the Contractor will notify the local authority regarding the nature, time, location and reasons for the over-run as soon as possible. Records will be kept of such events by the Contractor; and
  - Works that do not result in significant disturbance at nearby receptors may be considered to be undertaken during extended working hours subject to agreement with local authorities.

Monitoring

- Monitoring will be undertaken at specific locations, having been identified with regard for the plant in use and the activities undertaken at each work area, as agreed with local authorities;

- Monitoring will be focused on the early stages of each new construction activity or process and work undertaken during extended, night time and weekend working hours; and
- Compliance will be monitored against the requirements relating to construction method, working hours, plant inventories and plant operation.

5.8.3.7 Air Quality

Air quality effects will be controlled through selection of appropriate plant and machinery, careful planning of works and effective site management. Planning of works will take into consideration the nature of any source, local topography, prevailing wind patterns and local sensitive receptors (e.g. residential properties, schools, vulnerable habitats and sensitive industrial facilities).

Site Planning/ Site Activities

- No bonfires;
- Plan site layout – machinery and dust causing activities should be located away from sensitive receptors;
- Waste will be managed and removed from site on a regular basis to avoid excessive accumulation and odour nuisance;
- The excavation, storage and removal of any contaminated or water logged materials with the potential to release odour will be subject to specific measures to minimise odour release;
- Identify responsible person in charge;
- A risk assessment of work programme tasks to identify activities that have the potential to generate dust, their duration and their proximity to sensitive receptors, and to determine appropriate mitigation and management techniques to be employed; and
- Undertake regular visual inspections of dust raising activities to determine whether the appropriate mitigation and management techniques are being employed effectively. The frequency of these inspections will reflect prevailing meteorological conditions but are expected to be at least once daily. The results of the visual inspections are to be recorded and maintained.

Haul Roads

- Easily cleaned hard standing surfaces provided at access and egress points for the construction site;
- Haul roads and site access/egress points will be regularly maintained and kept clean;
- The following speed limits will be applied within the site boundaries to avoid excessive dust emissions:
  - 25 miles per hour (mph) (40 kilometres per hour (km/h)) on haul roads;
  - 15mph (24km/h) in pedestrian areas and adjacent to public areas.
- Haul roads will be damped down using water. Spraying will be repeated regularly and frequently during warm and sunny weather (including treatment for any run off containing suspended solids); and

- Where appropriate, wheel washing facilities will be provided and used by all vehicles leaving construction sites; and
- An approved mechanical road cleaner will be employed to clean the site hard standing and the public highway in the vicinity of the site.

Plant and Vehicles

- No idling vehicles – all vehicles will be required switch off engines when not in use;
- Vehicle / plant exhausts should be directed away from the ground;
- Minimise the movement of construction traffic around the site;
- Locate plant away from boundaries close to sensitive receptors;
- Control queuing or parking of vehicles outside the construction compounds/ areas, both during and before the sites open;
- On-road vehicles to comply to set emission standards;
- Avoid use of diesel or petrol powered generators by using mains electricity or battery powered equipment where possible (if safety concerns can be overcome);
- All non road mobile machinery (vehicles and plant) to be well maintained and regularly serviced according to manufacturer's recommendations and maintained to meet statutory emissions limits. Maintenance to include visual checks to ensure that black smoke is not emitted at times other than at ignition;
- Plant, equipment and emission control apparatus will be selected to minimise the production of dust and engine exhaust emissions, allowing for economic constraints and practicability;
- Cutting and grinding operations to be conducted using equipment and techniques which reduce emissions and incorporate dust suppression measures;
- Fixed wheel and/or vehicle washing at all site exits as well as procedures for effective cleaning and inspection of vehicles;
- All loads entering and leaving the construction site and carrying materials will be adequately sheeted to prevent the spillage of material during transport;
- Vehicles will not be overloaded;
- Enter all information of vehicles entering/leaving site in a log book; and
- Plant and equipment maintenance records will be kept on site.

Earthworks

- Completed earthworks will be sealed or seeded to minimise dust generation and stabilise surfaces as soon as practicable in accordance with the landscape proposals; and
- Exposed earthworks will be kept damp at all times, where required to prevent airborne dust emissions. Where this is not possible, windbreaks will be used to minimise the potential for dust generated by wind erosion.

Materials Handling and Storage

- Stockpiles, silos and mounds will be located out of the prevailing wind or windbreaks will be provided to minimise the potential for dust generation from stockpiles;
- Wherever possible stockpiles and mounds to be kept away from the site boundary, sensitive receptors, watercourses and surface drains and sited to take into account the predominant wind direction;
- Stockpiles will be maintained in a suitable aerodynamic form to minimise dust generation by wind erosion;
- Stockpiles will be maintained at the heights detailed or as otherwise agreed with the Roads Service;
- Stockpiles will be managed accordingly to minimise double handling;
- Construction materials will be stored within the construction site, away from the site boundary and downwind of sensitive receptors unless used for the purposes of screening;
- Stockpiled materials will either be sprayed with water if appropriate, or if the mounds are likely to remain undisturbed for a significant duration they will be sprayed with an appropriate chemical dust suppressant, or vegetated;
- When potentially dust generating materials are delivered to site the tipping height will be kept at a minimum and if it is greater than 2 metres suitable dust suppression measures will be utilised to control dust emissions;
- Seed, re-vegetate or turf long-term stockpiles to stabilise surfaces or use surface binding agents that have been approved by NIEA;
- Store fine dry material (under 3mm in size) inside buildings or enclosures; and
- Regularly inspect the construction sites for spillages of dusty or potentially dusty materials and have procedures in place for prompt clearance of any such spillage.

Concrete Work

- If concrete is to be mixed on site it should be mixed in enclosed/shielded equipment to prevent the escape of dust;
- Before concrete pours, the pour structure will be cleaned in the following manner to minimise dust emissions:
  - Move debris into corner of the pour structure; and
  - Suck out fine non-ferrous debris from pour area.

Demolition and Crushing

- Water will be used as a dust suppressant; and
- All crushing plant will be fitted with dust suppression equipment including water sprays. The suppression equipment will be used when necessary during the crushing activities.

UK Relevant Guidance

Process Guidance Note PG3/1 (04): Blending, Packing, Loading, Unloading and Use of Bulk Cement (Defra, Welsh Assembly Government and Scottish Ministers, June 2004);

Control of dust from construction and demolition activities (BRE, 2003);

Process Guidance Note PG3/16 (04) Mobile Crushing and Screening (Defra, Welsh Assembly Government and Scottish Ministers, 2004);

Controlling particles, vapour and noise pollution from construction sites (BRE, 2004) (set of five Pollution Control Guides); and

London Best Practice Guidance: The control of dust and emissions from construction and demolition. Mayor of London, (November 2006) (http://www.london.gov.uk/mayor/environment/air_quality/docs/construction-dust-bpg.pdf).

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Part 2 – Environmental Impact Assessment

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6 Approach and Methods

6.1 Introduction

The following chapter details the approach and methodology adopted for the EIA reported in this the ES.

6.2 Approach and Methods

A systematic approach has been adopted for this ES based on standard methodology of the DMRB Environmental Assessment as detailed within DMRB Volume 11[18] and with best practice guidelines from the relevant institutions and authorities. Significance criteria detailed in DMRB Volume 11 has been used to transparently evaluate effect predictions according to a clearly defined scale and within a generic framework, for consistency between topics. In this way the potential effects and benefits of the scheme are clearly presented.

In accordance with DMRB guidance[19], the absence or presence of the A8 Dualling scheme is referred to as the Do Minimum and Do Something scenario respectively.

The environmental assessment includes consideration of all impacts where effects on a receptor could be perceived as significant. Topic specific guidance provides recommended spatial assessment areas; however, unless otherwise specified, an area of 500m either side of the proposed A8 Dualling centreline has been taken.

A number of traffic studies and surveys have already been undertaken as part of this EIA and the wider scheme assessment. Traffic surveys were undertaken in spring 2008, including roadside interviews, automatic traffic counts, manual classified counts and journey time surveys. The data collected during these surveys provided information on the existing traffic conditions on the A8 and its side roads, which was used as the basis for developing a 2008 base year traffic model using SATURN software. The traffic model was developed to produce traffic forecasts for the proposed A8 Dualling scheme for the assumed year of opening 2016, and for fifteen years later at the design year, 2031, as well as an interim year of 2023. The traffic forecasts have been used to inform the operational, environmental and economic impacts of the proposed scheme.

In considering the programme and delivery of the scheme, the assessment has considered the baseline condition at September 2008, and has assumed that the works would be undertaken in accordance with the programme. In addition to the baseline year, other scenarios considered include:

- Opening year ‘Do Minimum’ – 2016;
- Opening year ‘Do Something’ – 2016;
- Design Year ‘Do Minimum’ – 2031; and

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[18] DMRB Volume 11 contains four sections which detail the aims and objectives of environmental assessment (Section 1), principles of environmental assessment (Section 2), assessment techniques (Section 3) and assessment of the implications on European Sites (Section 4).
[19] DMRB Volume 11: Section 2, Part 5, HA 205/08 Assessment and Management of Environmental Effects, Highways Agency. August 2008.

- Design Year 'Do Something' – 2031.

6.2.1 Screening

The scheme falls within Annex I to Council Directive 85/337/EEC (the EIA Directive) (as amended) and therefore an EIA is a requirement. No screening opinion was therefore sought for the need for an EIA for this scheme.

6.2.2 Scoping

An ES Scoping Report was issued to key statutory and non-statutory bodies outlining the approach, methodology, baseline conditions and expected effects of the scheme.

A formal scoping report provides statutory consultees with an overview of the scheme and sets out the baseline condition (including survey results where available), a summary of likely effects and the evaluation and assessment methodologies that will be followed. A Scoping report for the A8 Belfast to Larne Road Dual Carriageway (Coleman's Corner to Ballyrickard Road) was submitted to the statutory consultees in March 2010.

Responses to this scoping report and the wider consultation activities are detailed within chapter 7 'Scoping' of this ES.

6.2.3 Impacts and Effects

Impacts are defined as physical changes to the environment attributable to the construction and operation of the scheme, compared with the baseline conditions (where baseline conditions are defined as the environmental conditions that would develop without the proposed scheme). Effects are the consequences of an impact (i.e. the significance). The effects of impacts on existing resources and receptors may be adverse or beneficial, direct or indirect, temporary or permanent.

Activities that may give rise to impacts and effects during the construction and operation phases of this road improvement scheme will be considered within the assessment.

Table 8 details the typical activities and type of effects to be considered during the construction and operation phases.

Table 8 **Typical Construction and Operation Activities and Type of Effect**

Construction Activities
Temporary offices, compounds, storage areas and worksites; Temporary accesses and haul routes; Demolition of structures; Vegetation clearance, soil removal; Ground and excavation works; Creation of highway formation and surfacing; Routing of services and utilities; Drainage construction; Noise, vibration, lighting and disturbance resulting from construction works; and Pollution risk during construction.
Operation Effects
Permanent land take; Change in traffic flow and composition (and consequence for noise and air climate); Lighting, signs and junctions; Management practices, including landscape and vegetation management; and Hydrological change.
Type of Effect
Direct – effects that are directly attributable to the scheme; Indirect – effects resulting indirectly as a consequence of the scheme; Short term - <12 months; Medium term – Between 1 and 5 years; Long term - >5 years; and Permanent or irreversible. Beneficial and adverse effects

6.2.4 Spatial and Temporal Scope

Spatial - The area over which effects could occur is wider than the boundary of the proposed scheme. The scheme assessment area will vary depending on the subject under consideration. Specific assessment areas are described in each chapter, and allow for assessment of indirect as well as direct effects, together with off-site works.

Temporal - In considering the environmental effects of the proposed scheme, it is necessary to identify both adverse and beneficial effects, direct and indirect and also the duration of the effects, i.e. short, medium or long term.

6.2.5 Identification of Potential Receptors

Receptors are defined as the physical resource or user group that would experience an effect. The effect of an environmental impact would depend on the spatial relationship between the source and the receptor. Some receptors would be more sensitive to certain environmental effects than others. The baseline studies identify potential environmental receptors.

6.2.6 Significance Criteria

Much of the significance assessment is undertaken on the basis of the professional judgement of the team. Whatever the approach to impact assessment, the objective is to present a clear justification for the strategy adopted, and state all relevant assumptions to allow independent review.

Assessing the significance of environmental effects is not simple, since there are often no standards against which to make a comparison. The ES has relied upon reasoned arguments based on the advice and views of the specialist expertise of the study team.

Broadly, significance of any effect is a function of:

- The value of the resource (international, national, regional and local level importance);
- The magnitude of the effect, be it adverse or beneficial;
- The timescale involved, temporary or permanent; and
- The sensitivity of the receptor and numbers affected.
- The significance criteria will be that which is outlined in DMRB Volume 11, Section 2, Part 5, HA 205/08, Chapter 2 Determining Significance of Environmental Effects. Determining the significance of environmental effects includes the following:
- Assigning environmental value (Table 9);
- Assigning magnitude of impact (Table 10);
- Assigning significance (Table 11 and Table 12); and
- Cumulative effects (Table 13).

Table 9 **Environmental Value (or Sensitivity) and Typical Descriptors**

Value (sensitivity)	Typical Descriptors
Very High	Very high importance and rarity, international scale and very limited potential for substitution.
High	High importance and rarity, national scale, and limited potential for substitution.
Medium	High or medium importance and rarity, regional scale, limited potential for substitution.
Low	Low or medium importance and rarity, local scale.
Negligible	Very low importance and rarity, local scale.

Table 10 **Magnitude of Impact and Typical Descriptors**

Magnitude of Impact	Typical Criteria Descriptors
Major	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse).
	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial).
Moderate	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements (Adverse).
	Benefit to, or addition of, key characteristics, features or elements; improvement of an attribute quality (Beneficial).
Minor	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements (Adverse).
	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements (Adverse).
	Very minor benefit to or positive addition to one or more characteristics, features or elements (Beneficial).
No Change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

Table 11 **Descriptors of the Significance of Effects of Receptors**

Significance Category	Typical Descriptors of Effect
Very Large	Only adverse effects are normally assigned this level of significance. They represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category.
Large	These beneficial or adverse effects are considered to be very important, but are not likely to be material in the decision-making process.
Moderate	These beneficial or adverse effects may be important, but are not likely to be key decision-making factors. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse effect on a particular resource or receptor.
Slight	These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the project.
Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

Table 12 **Arriving at Significance of Effect Categories**

		MAGNITUDE OF IMPACT (DEGREE OF CHANGE)				
		No Change	**Negligible**	**Minor**	**Moderate**	**Major**
ENVIRONMENTAL VALUE (SENSITIVITY)	**Very High**	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
	High	Neutral	Slight	Slight or Moderate	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

6.2.6.1 Cumulative Effects

Effects that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the scheme are referred to as 'cumulative effects'. They may result in effects that are more than, or less than the sum of the individual effects. In the context of this ES, all projects with the potential to promote cumulative effects are considered as part of the assessment baseline for the site. This includes all development that is currently underway or has planning consent, or development designated within local development plans; such developments are collectively referred to as 'committed development'.

The reporting of the cumulative effects of the scheme will be detailed within each of the individual discipline chapters included in the ES, as detailed in DMRB Volume 11, Section 2, Part 6, HD 48/08 Reporting of Environmental Impact Assessments. Table 13 outlines the significance criteria for determining cumulative effects.

Table 13 **Determining Significance of Cumulative Effects**

Significance	**Effect**
Severe	Effects that the decision-maker must take into account as the receptor/resource is irretrievably compromised.
Major	Effects that may become key decision-making issue.
Moderate	Effects that are unlikely to become issues in whether the project design should be selected, but where future work may need to improve on current performance.
Minor	Effects that are locally significant.
Not Significant	Effects that are beyond the current forecasting ability or are within the ability of the resource to absorb change.

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7 Scoping

7.1 Introduction

As part of the EIA process, an ES Scoping Report was prepared and issued to key statutory and non-statutory bodies in March 2010. The report provided an overview of the scheme, and set out the baseline condition (including surveys results where available), a summary of likely effects and the evaluation and assessment methodologies that were to be adopted by this EIA.

A comprehensive programme of consultation was undertaken throughout the assessment stages and has informed the Preliminary Design development and mitigation strategies. The consultation strategy consisted of two elements:

- Consultation with the general public; and
- Consultation with the Statutory Bodies.

This chapter provides a summary of the consultation undertaken for this scheme assessment and summarises the resulting feedback.

7.2 The Consultation Process

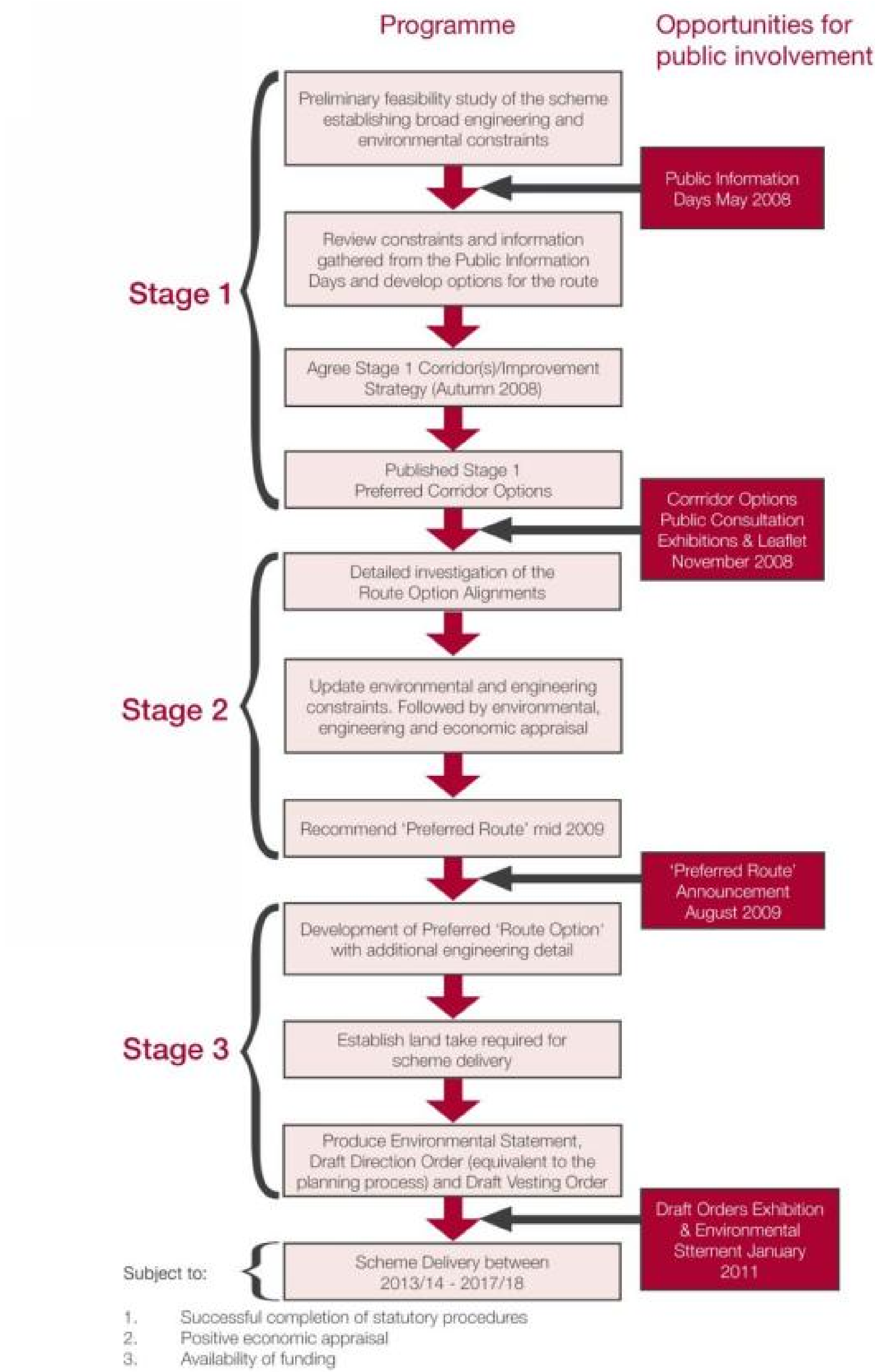
On commencement of the A8 Dualling scheme assessment process, Arup prepared a Public Consultation Strategy which was agreed with Roads Service at each stage of the DMRB scheme assessment process.

In addition, the strategy also seeks to follow best practice consultation guidelines including:

- Planning Policy Statement (PPS) 1: General Principles; and
- Public Involvement in Planning: The Government’s Objectives.

Figure 2 illustrates the key activities within the scheme programme which were incorporated into the consultation strategy.

Figure 2 **A8 Programme and Public Consultation Strategy**



Public consultation is a key part of the scheme assessment process. The overriding objective of the public consultation strategy was to ensure the consultation process is transparent, flexible and robust, and to allow the public and key stakeholders to be engaged at the key stages of the process. The following specific objectives were included, and have helped guide the consultation process:

- To seek local knowledge and information from the public which may assist in the planning and development of route corridors/options;
- To ensure affected property owners, members of the public and other key stakeholders are provided with sufficient, timely, information about the scheme and its likely impacts so they may provide informed input;
- To ensure appropriate and direct communication with property and land owners to aim to accommodate their preferences;
- To encourage public support and participation throughout all stages of scheme assessment to facilitate more acceptable outcomes;
- To provide a range of accessible opportunities for the public to contribute to the scheme assessment process;
- To build an ongoing relationship between Roads Service, the study team and the public in order to gain long term support for the scheme; and
- To provide an effective, open and accountable process.

7.2.1 Public Information Events

7.2.1.1 Stage 1 Public Information Days

The Stage 1 scheme assessment process involved the identification and assessment of broad improvement strategies (in the form of wide corridors) leading to the recommendation of preferred corridors to be assessed in more detail in Stage 2. The Stage 1 public consultation focused on existing engineering and environmental constraints as well as presenting the scheme in the context of the RDS and RTS and the overall case for the scheme.

Traditionally the public would not have been actively engaged with a major road improvement scheme until later in the scheme assessment process. However, it was agreed with Roads Service in line with the consultation strategy and its objectives, that the community would be engaged at an early stage in the project before any corridors were generated.

On this basis, Public Information Days were arranged for Tuesday 20th May 2008 (2.00 pm - 9.00 pm) and Wednesday 21st May 2008 (2.00 pm - 9.00 pm). The Public Information Days were held at Corr’s Corner Hotel, 315 Ballyclare Road, Newtownabbey, Co. Antrim, BT36 4TQ.

7.2.1.2 Stage 1 Corridor Options Consultation

Following the Public Information Days, held in May 2008, corridor options for the improvement of the A8 were developed, taking into consideration comments received during and after the Public Information Days.

Two corridor options were recommended to be taken forward to Stage 2. These two corridor options were presented to the public at the Stage 1 Corridor Options Public Consultation.

The key objectives of the Stage 1 Corridor Option Consultation were to:

- Outline the scheme development process;
- Outline the timescale for the development of the scheme;
- Raise awareness of the benefits of the scheme;
- Gather specific feedback on the corridor options developed;
- Gather overall feedback on the scheme;
- Gather local knowledge of existing features and conditions; and
- Collect landowner information and contact details.

A Public Consultation Exhibition was held at the Corr's Corner Hotel, Ballyclare Road, Newtownabbey on Tuesday 11th and Wednesday 12th November 2008 between 1pm – 9.00pm.

7.2.1.3 Stage 2 Preferred Route Announcement

During the Stage 2 assessment, a range of route options were developed within the recommended Stage 1 corridors based on the key constraints identified in the assessment. These were assessed against the five Government objectives for transport. A Preferred Route was selected following this detailed assessment and consideration of the comments received during the Stage 1 consultation process.

The key objectives of the Stage 2 Preferred Route Announcement were to:

- Present the Preferred Route for the A8 and the assessment process in a range of accessible formats;
- Present the rejected options and the reasons for their rejection;
- Provide opportunity for the public to discuss concerns with the Roads Service team and a range of technical specialists depending on the nature of their concerns; and
- Discuss the next stages of the project, particularly with those who are potentially directly affected by the scheme.

A Preferred Route Announcement Exhibition was held at the Corr's Corner Hotel, Ballyclare Road, Newtownabbey on Wednesday 5th and Thursday 6th August 2009 between 2pm – 9.00pm. This included a Ministerial Announcement made by the Minister for Regional Development Conor Murphy, on the 5th August 2009 prior to the opening of the exhibition to stakeholders and the public. Letters of invitation to the Ministerial Announcement were sent to key stakeholders and political representatives.

A full copy of the Consultation Report is available from Arup on request.

7.2.2 Environmental Liaison Group (ELG)

In recognition of the increasing value of information received from consultees, five Environmental Liaison Group (ELG) meetings have been convened for this scheme between 2008-2010 to provide a regular forum for structured consultation. This has included:

- ELG meeting #1: To introduce the scheme and the progress made on Stage 1 environmental study (May 2008);
- ELG meeting #2: To update key stakeholders on the progress of the scheme and to discuss key environmental issues (November 2008);
- ELG meeting #3: To provide an overview of Preferred Route selection and next stages of environmental assessment (November 2009);
- ELG meeting #4: To discuss the Scoping Report, requirements for any further surveys and mitigation strategies that were being formulated (April 2010); and
- ELG meeting #5: To provide an overview of the proposed scheme and environmental assessment and design undertaken (October 2010).

The minutes of each of the ELG meetings have been distributed among attendees and are available upon request from Arup.

In addition to the ELG meetings, a number of focus group meetings were held with individual and/or similar interest consultees with the purpose of providing a more focused and detailed forum in which to discuss topic specific issues that were more suited to discussion outside the ELG. These are described in the relevant topic chapters.

It was recognised that some subject areas required data and advice from organisations that are not represented in the ELG; in these cases individual consultation with such bodies took place.

7.3 List of Consultees

Consultation has been undertaken with statutory and non-statutory organisations throughout the scheme development and assessment process including:

Statutory Bodies

- DRD Roads Service;
- Northern Ireland Environment Agency (NIEA) – Built Heritage, Natural Heritage, Water Management Unit (WMU), Waste and Contaminated Land;
- Department of Agricultural and Rural Development (DARD) – Countryside Management and the Rivers Agency;
- Department of the Environment (DOE) Planning Service – Headquarters, Newtownabbey Area Team (Belfast Office), Larne Area Team (Ballymena Office) and Landscape Architects Branch;
- Department of Culture, Arts and Leisure (DCAL) – Inland Waterways and Fisheries Unit; and
- Larne Borough Council and Newtownabbey Borough Council.

Non-Statutory Bodies

A selection of non-statutory bodies was consulted via the ES scoping process. The following bodies were sent a copy of the ES Scoping Report and asked to provide comments if applicable.

One to one consultation was undertaken with the Woodland Trust as they have a property, Clements Wood, which would be impacted upon by the scheme.

The following is a summary of the comments received from the non-statutory consultees:

- Geological Survey Northern Ireland (GSNI) – No response received to scoping report;
- Royal Society for the Protection of Birds (RSPB) – The RSPB confirmed receipt of the scoping report but made no further comments;
- Woodland Trust – Formal scoping response received. The Woodland Trust's objectives are to assist where possible with the planting of surplus land throughout the area with native trees. The response also included specific compensatory details relating to the land-take required from Clements Wood. This includes upgrading vehicular access and the provision of a brown tourism sign to highlight the presence of Clements Wood;
- Ulster Wildlife Trust – No response received; and
- The National Trust – No response received.

More details of who was consulted as part of each discipline assessment are set out in each of the topic chapters of this ES.

7.4 Key Issues Raised by Consultees

A summary of the key issues raised by statutory bodies throughout the scoping and consultation process is documented in Table 14. The summary also includes the follow up actions which were undertaken throughout the EIA process to address the concerns raised.

Table 14 **Summary of key issues raised by statutory stakeholders throughout the consultation process**

Consultee		**Issues Raised**	**Actions/Response**
Northern Ireland Environment Agency	Natural Heritage	Key issues raised by NIEA Natural Heritage at various ELG meetings and other consultation meetings included: Smooth Newt - Identification of areas of habitat supporting smooth newts. Badgers – Need to understand what badger activity currently exits. Identifying main and outlier setts. Should any setts need closing, an application to the NIEA Wildlife Officer would be required. Bats – Bats were highlighted as a key concern. The assessment should identify historic routes between foraging and roosts along proposed A8 route. Mitigation needs to be discussed with NIEA to agree best strategy. The assessment should also consider the effects of the lighting strategy on bats and other species and habitats. Otters – Main concern regards amount of new culverts. NIEA has a presumption against culverting. Where existing culverts are to be widened this needs to be discussed with the Water Management Unit, DCAL Inland Fisheries and Rivers Agency and proposals agreed with NIEA Natural heritage in terms of meeting standards for otter provision. Tree preservation order – Identifying the effect on any TPOs. Clements Wood – Identify any impacts upon the wood. The Woodland Trust should be involved in consultation in relation to Clements Wood.	Surveys for protected species have been undertaken. The results of which are presented in chapter 8 of this ES. The environmental masterplan drawings (see Appendix M, ES Volume II) illustrate the environmental design features which have been included in the preliminary design to accommodate protected species identified by the nature conservation assessment. Any additional mitigation measures are detailed within chapter 8 of this ES. All environmental design features and additional mitigation proposals have been subject to continued consultation with NIEA Natural Heritage throughout the EIA process. Consultation with the Woodland Trust was undertaken on 1 July 2010 to discuss the impact of the scheme on the Clements Wood site.
	Built Heritage	Lowtown Rath – NIEA Built Heritage were concerned about the setting of the Lowtown Scheduled Historic Monument (SHM). The scheme must not enter the scheduled area surrounding the rath. Treatment of the boundary should include the reinstatement of the hedgerows at the same height as the existing to minimise changes to the monuments setting. Unknown Archaeology – NIEA were concerned about appropriate	The NIEA were consulted on the alignment of the proposed scheme at the location of the Lowtown Rath to ensure that they are satisfied with the proximity of the road and the treatment of the boundary. Details are included within chapter 10 Cultural Heritage. A number of meetings were held with NIEA Built Heritage including a focus group with Arup, the Roads

Consultee		Issues Raised	Actions/Response
		pre-development testing to identify unknown archaeology. The NIEA require the development of an archaeological mitigation strategy to be agreed by the area archaeologist. Recording of heritage features lost due to the scheme – All heritage features identified within the cultural heritage assessment (chapter 10) as lost due to the scheme are to be appropriately recorded. Where this is likely, it should be included in the mitigation strategy.	Service, the contractor and NIEA to discuss the approach to pre-development testing. A mitigation strategy has been agreed in principle and a site walkover was undertaken by an Arup archaeologist and the area archaeologist to identify areas requiring testing. Details of the strategy are included in chapter 10.
	Water Management Unit	Key concerns for the NIEA WMU included: Pollution Prevention – Ensuring that appropriate pollution prevention measures are implemented by the contractor during construction to avoid negative impacts on water quality and aquatic ecology within watercourses within the area. Water Quality – NIEA must be satisfied that the scheme will comply with the Water Framework Directive (WFD) and ensure that there is no deterioration in water quality or on future water quality objectives.	The NIEA WMU was consulted throughout the development of the preliminary design via the ELG forum and more focused consultation. A drainage design and pollution prevention focus group was held by Arup on 20 May 2010. The purpose of the meeting was to discuss and highlight the importance of pollution prevention measures during construction. It was agreed that close consultation between the Roads Service and the contractor will continue through the detailed design stage and construction. chapter 12 Road Drainage and the Water Environment details the key pollution prevention guidelines (PPGs) to be adhered to during the construction process.
Department for Culture Arts and Leisure	Inland Fisheries	Culverts – Fish passage through culverts was identified as a key concern. DCAL would like to see appropriate measures designed into any required culverts to make fish passage easier. This includes e.g. reducing length, low flow velocities, pools above and below culvert for fish to rest, inclusion of a light well. Also concerned that this may impact fish migration and spawning activities. DCAL would need to assess proposals for all new and extended culverts for impact upon fisheries. Discharge – Concerns regarding levels of suspended solids and amount of water being discharged to rivers that may result from	DCAL have been consulted on all river realignments and culvert and structure proposals. This included presenting drawing and culvert schedule for consideration of DCAL. The culvert schedule indicates if fish passage measures are incorporated in the culvert design. A drainage design and pollution prevention focus group was held by Arup on 20 May 2010. The purpose of the meeting was to discuss and highlight the importance of pollution prevention measures during

Consultee		Issues Raised	Actions/Response
		runoff. DCAL suggested that settlement ponds could be used to attenuate the discharge. Fish survey – DCAL requested a fish population and habitat survey to be undertaken as part of the EIA. DCAL have a statutory duty under the Fisheries Act (Northern Ireland) 1966 and the North Atlantic Salmon Conservation Organisation (NASCO) Treaty to protect, maintain and enhance salmonid populations within rivers. River Realignments – The scheme includes a number of river realignments. DCAL were concerned about the impact these may have on fish populations. DCAL also highlighted the opportunity to enhance the river conditions for fish populations within appropriate channel realignments.	construction. It was agreed that close consultation between the Roads Service and the contractor will continue through the detailed design stage and construction. Chapter 12 Road Drainage and the Water Environment details the key pollution prevention guidelines (PPGs) to be adhered to during the construction process. Arup commissioned a fisheries population and aquatic habitat survey on the watercourses affected by the scheme. The survey included electro-fishing population surveys and habitat surveys. The report by Ecofact Environmental Consultants Ltd is included in Appendix C, ES Volume II.
Department for Agriculture and Rural Development	Countryside Management	Hedgerows – DARD Countryside Management are concerned with ensuring that the importance of the retention and replacement of hedgerows along the scheme for the protection of local countryside habitats is recognised. Planting regimes should include local species with Blackthorn as the local dominant species. Countryside Management Scheme – Identification of land or farms which are farmed under the Countryside Management Scheme.	The planting strategy developed as part of the nature conservation and landscape assessments has incorporated the recommendations of DARD and ensured that appropriate local species are specified. Agricultural Impact Assessments (AIAs) have been undertaken by McIlmoyle & Associates which have identified land which is currently part of the Countryside Management Scheme.
Department for Regional Development	Rivers Agency	Flood Risk - The key concern of the Rivers Agency was the impact of the dualling on flood risk within the scheme assessment area at locations upstream and downstream of the watercourses affected, and whether any areas of flood plain would be lost.	Consultation with the Rivers Agency had been ongoing between the design team throughout the development of the preliminary design. A flood risk assessment (FRA) was prepared and submitted to the Rivers Agency for comment together with all drainage proposals for the scheme.
Planning Service	Newtownabbey Area Team	The Newtownabbey area team has no key concerns regarding the scheme. Updates regarding the status of the Belfast Metropolitan Area Plan (BMAP) and development consents were provided during	Planning consent queries were undertaken to obtain information regarding relevant developments within the scheme assessment area. This ES has also

Consultee		**Issues Raised**	**Actions/Response**
		the ELG forum and as part of the wider data gathering process.	examined and taken into consideration the plans and proposals within the BMAP.
	Larne Area Team	The Larne area team had no issues with the scheme. They provided updates as to the status of the proposed Antrim, Ballymena and Larne Area Plan 2016 which is currently on hold.	Planning consent queries were undertaken to obtain information regarding relevant developments within the scheme assessment area. This ES has also examined and taken into consideration the plans and proposals within the Larne Area Plan.
	Landscape Architects Branch	The Landscape Architects Branch did not attend the ELG forums and did not provide a response to the ES Scoping Report.	Landscape Architects Branch will be sent a copy of this ES including the landscape assessment (chapter 9 of this ES) which examines the effect of the scheme upon the wider landscape.
Local Councils	Newtownabbey Borough Council	Newtownabbey Borough Council did not raise any key concerns throughout any of the ELG forums. They did not provide a formal response to the ES Scoping Report.	No action required.
	Larne Borough Council	Noise Effects – The main concern of the Larne Borough Council Environmental Health Department was the effect of the dualling on noise levels experienced by sensitive receptors. The council commented through the ELG forum that they are satisfied with the DMRB methodology for noise assessment.	This ES has undertaken a noise assessment, the results of which are detailed in chapter 13 of this ES. The approach for the assessment has followed DMRB guidance as stated in Volume 11, Section 3, Part 7 HA 213/08 Noise and Vibration.

8 Nature Conservation

8.1 Introduction

This chapter presents an assessment of the effects upon local ecological resources and nature conservation interests as a result of the upgrading of 14km stretch of the A8 Belfast to Larne Road from Coleman's Corner to the B100 (Ballyrickard Road), from single carriageway to dual carriageway standard.

This chapter describes the ecological resources present and determines their relative value. The significance of effects during construction and operation of the proposed scheme on sensitive ecological receptors and any mitigation measures has been considered in assessing the residual effects after mitigation.

8.2 Legislation and Guidance

The following legislation exists to protect habitats and species of nature conservation importance in Northern Ireland

- The Conservation (Natural Habitats, &c.) Regulations (Northern Ireland) 1995 (as amended), which transposes, Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and flora ("the Habitats Directive") in to law in Northern Ireland;
- The Wildlife (Northern Ireland) Order 1985 (as amended) is the principal mechanism for the legislative protection of wildlife in Northern Ireland. Protected species are listed in the Schedules to the Order (see **Appendix C, ES Volume II**). This piece of legislation makes it an offence to:
  - Intentionally kill, injure, or take any wild bird or their eggs or nests. Special penalties apply for offences related to birds listed on Schedule 1, for which there are additional offences of disturbing these birds at their nests, or their dependent young;
  - Intentionally or recklessly kill, injure, take, possess, or trade in any wild animal listed on Schedule 5, and prohibits interference with places used for shelter or protection, or intentionally disturbing animals occupying such places; and
  - Release any animals or cause to grow in the wild any plants listed on Schedule 9.
- The Environment (Northern Ireland) Order 2002 provides the Department of Environment for Northern Ireland with the power to declare areas of land as Areas of Special Scientific Interest (ASSI) where the land is of special interest by reason of its flora, fauna, geological, physiographical or other features; and
- The Fisheries Act (Northern Ireland) 1966 makes it an offence to injure or disturb the spawn or fry of salmon, trout or eels or injure or disturb any spawning bed, bank or shallow where the spawn or fry of salmon, trout or eels may be.

In addition to the legislation listed above, the following policies exist to promote the conservation of habitats and species within the UK and Northern Ireland:

- The UK Biodiversity Action Plan (UK BAP);
- Northern Ireland Biodiversity Strategy (NIBS);
- Northern Ireland Biodiversity Implementation Plan April 2009 to March 2012;
- Northern Ireland Habitat and Species Action Plans; and
- Planning Policy Statement 2 (PPS 2): Planning and Nature Conservation (DOE June 1997).

8.3 Scoping and Consultation

8.3.1 Scoping

An ES Scoping Report was issued in March 2010 to key statutory and non-statutory bodies outlining the approach, methodology, baseline conditions and expected effects of the proposed scheme.

It was circulated to all stakeholders, offering them an opportunity to address the proposed methodologies for the EIA or to address issues that have not been adequately covered. A list of consultees is included in chapter 7.3.

Specific ecological consultees included:

- Northern Ireland Environment Agency (NIEA) Natural Heritage;
- Department of Agriculture and Rural Development (DARD) Countryside Management; and
- Department of Culture Arts and Leisure (DCAL) Inland Waterways and Fisheries.

8.3.2 Consultation

Additional consultation with representatives of NIEA and DCAL has been undertaken as part of a series of ELG meetings. Further consultation with the NIEA was undertaken throughout the development of the proposed scheme to agree the scope of works and requirements for the assessment.

An initial view on the scope of the surveys and potential impacts was received from NIEA in November 2009. This was followed by a formal Scoping Report which was sent to NIEA in March 2010 to confirm the extent of surveys for each species group, based on the initial results. DCAL Inland Waterways and Fisheries have been consulted regarding the requirement for fish surveys within the scheme assessment area. The scope of the surveys and assessment has been agreed with the consultees.

8.4 Assessment Methodology

The nature conservation assessment has been undertaken in accordance with the guidance contained in the DMRB Volume 11, Section 3, Part 4 'Ecology and Nature Conservation', using additional species specific guidance where appropriate and the Institute of Ecology and Environmental Management's Guidelines for Ecological Impact Assessment in the United Kingdom 2006 (IEEM

2006)[20]. These pieces of guidance aim to promote a scientifically rigorous approach to Ecological Impact Assessment, while also acknowledging that the process relies on professional judgement. Where there are limitations to the assessment these have been stated and a precautionary approach has been taken.

The assessment has involved the identification and evaluation on a geographic scale (international, national, regional, county and local) of features of ecological interest that may be affected by the works through the review of the desk study information and field surveys. An assessment has been made in accordance with IEEM guidelines as to the effect of the predicted changes on the ecological structure and function to determine how the integrity of sites and the conservation status of species will alter.

8.4.1 Scheme Assessment Area

The scheme assessment area considers ecological features of interest within 200m of the proposed scheme. However, this threshold has been extended in accordance with DMRB and best practice guidance where particular features lie partially within and beyond this area, or where it has been deemed necessary for protected species surveys. The scheme assessment area for the proposed scheme is approximately 14.4km long and up to 1km wide in places.

8.4.2 Methodology for Establishing Baseline Conditions

8.4.2.1 Desk Study

A desk study was undertaken to identify and evaluate ecological features (sites, habitats and species) that may be affected by the proposed scheme. This comprised consulting with relevant statutory bodies and non-statutory organisations to obtain ecological data for an area approximately 2km either side of the proposed scheme. The data obtained included:

- Information on designated sites such as Special Areas of Conservation (SAC), ASSI and Sites of Local Nature Conservation Importance (SLNCI);
- Records of plants or animal species within the scheme assessment area were obtained from the Centre for Environmental Data and Recording (CEDaR);
- Fisheries information was obtained from the DCAL Inland Waterways and Fisheries; and
- Bat records within the vicinity of the scheme have been received from the Northern Ireland Bat Group.

[20] Guidelines for Ecological Impact Assessment. Institute of Ecology and Environmental Management, 2006.

8.4.2.2 Field Survey

Extended Phase 1 Habitat Survey

An Extended Phase 1 Habitat survey following the 'Extended Phase 1' methodology as set out in the Guidelines for Baseline Ecological Assessment[21] and in accordance with the guidelines of the Joint Nature Conservation Committee (JNCC)[22] was conducted throughout the survey area during 2009. This entailed a walkover survey of the scheme assessment area during which ground-truthing[23] of habitats preliminarily identified from aerial photographs was undertaken. Target notes were used to describe habitat and species composition and highlight features of ecological interest. Incidental records of fauna were also made during the survey and the habitats identified were evaluated for their potential to support protected species and other species of conservation concern, including Biodiversity Action Plan (BAP) priority species. The survey considered the presence/likely absence for a number of protected fauna species including:

- Otter;
- Bat species;
- Badger;
- Wintering and breeding birds;
- Herpetofauna; and
- White-clawed crayfish.

Further ground-truthing of the habitat types present within the scheme assessment area was undertaken during 2009-2010.

National Vegetation Classification

Detailed botanical monitoring was undertaken on areas of habitat identified in the Phase 1 Habitat survey as being of higher ecological quality. The first stage involved compiling a species list for each of these areas, and the second involved collecting data from a series of quadrats[24].

The overview species lists were compiled by walking a series of informal transects crossing the site in several directions and aimed to include all variations within each area. Every species seen was recorded, and an estimate of its abundance made using the DAFOR scale (where D = Dominant, A = Abundant, F = Frequent, O = Occasional and R = Rare. L is sometimes used as a prefix for species with localised distribution, e.g. LF = Locally Frequent). All nomenclature follows Stace (1997)[25].

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[21] Institute of Environmental Assessment *Guidelines for Baseline Ecological Assessment*, E & FN Spon, 1995.
[22] Joint Nature Conservation Committee (JNCC) *Handbook for Phase 1 habitat survey - a technique for environmental audit*. Revised reprint 2003, reprinted 2007.
[23] Ground-truthing is a term used in mapping to compare data on the ground to data collected from remote sensing techniques.
[24] A quadrat is an ecological sampling unit that consists of a square frame of known area. They are used to determine the percentage of vegetation and/animal species occurring within areas of consistent size and shape, to enable comparable samples to be obtained from different areas.
[25] Stace, C. *New flora of the British Isles* 2nd edition. Cambridge University Press, 1997.

The quadrat monitoring followed standard National Vegetation Classification (NVC) methods[26]. NVC surveys were undertaken between May and June 2009. The quadrat locations were chosen so that they reflect homogenous areas of vegetation within the study site. Within each homogenous stand, quadrat samples representative of the stand are selected. Quadrat size is determined by vegetation type as follows:

- 2x2 m short herbaceous vegetation, dwarf-shrub heaths;
- 4x4 m short woodland field layers, tall herbaceous vegetation, heaths, open vegetation;
- 10x10 m dense scrub, tall woodland field layers, species-poor herbaceous vegetation; and
- 50x50 m woodland canopy and shrub layers, sparse scrub.

Every species observed in a quadrat was recorded and its cover within the quadrat estimated using the Domin scale, shown in Table 15. An area of approximately 1m around the quadrat was also scanned and any species not present in the quadrat noted.

Table 15 **Domin Scale for Recording Vegetation Cover**

Percentage Cover	Domin Scale
91-100%	10
76-90%	9
51-75%	8
34-50%	7
26-33%	6
11-25%	5
4-10%	4
<4% - many individuals	3
<4% - several individuals	2
<4% - few individuals	1
Associated species within 1m of quadrat	A

The quadrat data was collated into a table for each area and the occurrence of each species within each group of quadrats was then assigned a constancy score as indicated in Table 16. The species within each table were then listed in order of their constancy score.

Table 16 **Constancy Scores for Quadrat Data**

Frequency within Quadrat	Constancy Score
81-100%	V
61-80%	IV
41-60%	III
21-40%	II

[26] Rodwell, J. *National Vegetation Classification: Users Handbook*, JNCC, 2006.

Frequency within Quadrat	Constancy Score
1-20%	I

Data collected was analysed using the computer software MAVIS[27] which provides the best possible NVC classification of the vegetation into a community type. A goodness of fit was given for each classification. This provided an indication of how well the vegetation present fits the NVC classification that the software has provided. The ratings of overall goodness of fit values are outlined in Table 17.

Table 17 **Goodness of Fit Ratings**

Goodness of Fit	Rating
80-100	Very good
70-79	Good
60-69	Fair
50-59	Poor
0-49	Very poor

MAVIS also gives Ellenberg indicator scores for likely ground conditions within individual quadrats in terms of moisture levels, light levels, pH, salt levels and nitrogen levels. Ellenberg indicator values were defined by Ellenberg (1979; 1988; 1991) to characterise the recognised individual ecological niche of many of the vascular plants of central Europe in terms of the above abiotic conditions. The values were recalibrated by Hill *et al.* (1999) to determine the ecological niche of vascular plants in the UK. Ellenberg scores therefore allow inferences about the soil conditions to be made based on the species present at a site.

Controlled Plants

Information on controlled plants listed on Part II of Schedule 9 to The Wildlife (Northern Ireland) Order 1985 was gathered during the course of the surveys, and their extent and location mapped.

Otters *Lutra lutra*

Otter surveys of the watercourses within the scheme assessment area have been designed to establish the level of otter activity, distribution of otters, and the location of any places of shelter. The survey for otters was undertaken during April 2010 by experienced ecologists, based on recommendations provided by

[27] **MAVIS** is a programme for analysing vegetation data using different types of classifications developed for Great Britain. Data on plant species collected from sample areas constitute the basic information used by ecologists to answer a range of questions about vegetation. These questions are often answered by classifying the field data in different ways. Various classifications have been developed, which all attempt to explain or describe the distribution of plant species at different scales. Those used in this assessment are Ellenberg scores for Light, Fertility, Wetness and Ph; and the National Vegetation Classification (NVC) developed at the Unit of Vegetation Science, Lancaster University.

three authoritative sources (Chanin (2003)[28]; Crawford (2003)[29]; Strachan & Jeffries (1996)[30]).

The banks of rivers and streams were surveyed within the site boundary and for a distance of approximately 500m up and downstream from the extent of the indicative centreline of the proposed scheme. Each watercourse was characterised and described (watercourse descriptions are included in **Appendix C, ES Volume II)**. The following criteria were recorded:

- Watercourse width;
- Watercourse depth;
- Substrate;
- Current/flow;
- Bordering land use; and
- Bank vegetation.

Both banks of each watercourse were searched for signs of otter presence including spraints (droppings), anal jelly (a glutinous excretion used for scent marking), foot prints, pathways and slides, holts (dens), couches (lying up sites) and feeding remains. Where signs were found the location was recorded and mapped, and notes made on the number, age and level of activity indicated by the signs found.

Holts are resting places located beneath tree roots or rocks and are often used for longer periods when otters are inactive during the day. Above ground resting places are usually found in areas of denser vegetation such as reedbeds and scrub and are referred to as couches. Resting places during the surveys were classified as follows:

- **Confirmed**: Use by otters confirmed through direct sightings or presence of significant amounts of spraint at entrances or within resting place; or
- **Possible**: Area suitable to be used by otters as resting site and some evidence pointing to the presence of otters which could not be confirmed as an actively used site.

Bat Species

Bat surveys were designed to determine the presence of any bat roosts within the vicinity of the proposed scheme and to assess the level of bat foraging activity along the existing road and in green field areas which are to be crossed by the scheme.

During the Extended Phase 1 survey buildings and trees were assessed for their suitability to support roosting bats. Buildings were inspected externally for suitable roosting sites such as gaps between the stonework and the eaves. Similarly, trees were inspected for potential roost sites including splits, holes, broken limbs and loose bark. Evidence of the likely presence of bats was also searched for, including droppings, staining and scratch-marks around potential entrances.

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[28] Chanin P. *Ecology of the European otter*. English Nature, 2003
[29] Crawford, A. Fourth Otter Survey of England 2000-2002. Environment Agency, 2003
[30] Strachan, R., Jefferies, D.J. Otter Survey of England 1991-1994. Vincent Wildlife Trust, 1996

Bat surveys were undertaken during suitable weather conditions in May-September 2009 by Arup bat specialists and in June-August 2010 by Dr Kerry Crawford under sub-contract to Arup. Surveys followed current best practice guidelines published by English Nature[31], the Bat Conservation Trust[32] and NIEA[33].

The bat surveys comprised a series of emergence and activity surveys lasting from thirty minutes before sunset until two hours after sunset. Batbox Duet bat detectors were used to detect and identify bats which were recorded along with observations of bat behaviour. Detectors were connected to a digital recorder which allowed later analysis of bat calls using the Batsound™ programme to confirm species identification. Anabat™ detectors were also left at specific locations identified during the Extended Phase 1 survey where the proposed route crosses linear features such as hedgerows and watercourses.

Badgers Meles meles

An extensive survey for badgers within the scheme assessment area was conducted by experienced ecologists during November 2009 and February-June 2010. This survey aimed to ascertain sett locations, paths and foraging territory of individual badger clans. The surveys were undertaken in accordance with best practice and standard guidelines (Harris *et al*. 1989[34], Macdonald *et al*. 1998[35]). Within the survey area field boundaries, copses, woodlands and other features with potential to be used by badgers were walked to record signs of badger activity such as latrines, foot prints, paths, setts and foraging (snuffle) holes.

All indications of badger activity were recorded and mapped. Target notes were also made, describing features of potential importance to badgers and detailing all signs of badger activity that were encountered during the surveys.

All badger setts found were assessed and classified into the categories below, according to the level of use evident and the number of entrance holes present. Categories of use and their defining characteristics are as follows:

- **Main Sett**: These are typically large and well-established setts that are generally in continuous use by a single badger clan. These setts are likely to be the locations where cubs of that social group are born and reared;
- **Annexe Sett**: These are typically smaller setts than main setts, with fewer holes. Usually, annexe setts are present in close association with the main sett and are often linked to it by well-worn paths. Annexe setts are sufficiently separated from the main sett to not be linked by underground tunnels to it; and
- **Outlying Sett**: These setts are used on an occasional basis and will often consist of only one or two entrance holes. Outlying setts are often located in association with seasonal feeding areas such as orchards or agricultural crops.

[31] Bat Mitigation Guidelines. English Nature, 2004.
[32] Bat Surveys: Good Practice Guidelines. Bat Conservation Trust 2007.
[33] Bat surveys – NIEA Specific Requirements 2010.
[34] Harris, S., Cresswell, P. & Jefferies, D. Surveying for badgers. Occasional Publication of the Mammal Society No. 9. Mammal Society 1989.
[35] Macdonald. D.W., Mace, G. & Rushton, S. Proposals for future monitoring of British mammals. Department of the Environment, Transport and the Regions, and Joint Nature Conservation Committee 1998.

Ornithology

Ornithological surveys were undertaken to establish avian diversity and the presence of Schedule 1 species and other species of conservation concern. The Phase 1 habitat survey identified habitats and features that would be suitable for breeding and/or wintering birds. Suitable habitats recorded included open grassland, field edges, woodland copses, hedgerows and aquatic/riparian habitats.

During the breeding season, taken to extend from February to September, many individual birds are restricted to relatively small areas, actively defending a territory or spending much time around a nest. These birds can be identified by species and their activity recorded to determine likely breeding of these birds within an area. Most birds can be assumed to be breeding in the following situations:

- If one or a pair of adult birds are observed within suitable breeding habitat for that species;
- If an adult bird is observed carrying nesting material or food; or
- If an adult bird is singing and/or actively defending a territory.

Breeding is confirmed if a nest is found or if chicks/juveniles are observed.

The methodology used was based on the Breeding Bird Methodology described in Gilbert *et al*. 1998[36]. In accordance with this, two bird count visits were undertaken by experienced ecologists/ornithologists between April and June 2009. Transect lines were walked on both sides of the existing A8 and observations of bird behaviour (including singing, calling, alarm calling, nesting, flights and aerial disputes) were made on field maps using standard British Trust for Ornithology (BTO) species codes. Flight direction and flock size were included to help minimise the potential for double counting. Adverse weather conditions such as strong wind, persistent rain, and dense fog were avoided as far as was possible, although strong wind was a persistent factor during the second breeding bird survey.

During these visits barns and trees within the scheme assessment area were assessed for their suitability to be used by barn owls.

Herpetofauna

Habitat assessments were undertaken regarding the necessity to undertake formal herpetological surveys. This relates to the presence of smooth newt *Lissotriton vulgaris*, within suitable waterbodies and the presence of viviparous lizard *Zootoca vivipara* within suitable habitat.

Smooth newts are found in a range of habitats including uplands, woodland, marshland, open moorland and agricultural land. The breeding habitats of smooth newts range from large lakes through small to medium ponds and densely weeded ditches. Suitable waterbodies vary in size but have been defined as a body of standing water, between 1m^2 to 2ha in area, which usually holds water for at least

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[36] Gilbert G. Gibbons D.W. & Evans J. *Bird Monitoring Methods*. Royal Society for the Protection of Birds, 1998.

four months of the year (Williams *et al.* 1998[37]). Small ponds (<200 m²) between 0.5-1.0m deep and at least partly vegetated are the ideal habitat for smooth newts (Beebee 1981[38]). Areas of standing water which have the potential to be affected by the proposed scheme were then surveyed for smooth newts by a licensed surveyor. Surveys were undertaken during suitable weather conditions at the appropriate time of year between May and June 2010. Two methods were used on each of two occasions to determine presence or likely absence of smooth newts in suitable waterbodies:

- **Egg Search** – Submerged vegetation was searched for the presence of smooth newt eggs. The eggs are usually wrapped in the leaves of aquatic plants such as water mint and water forget-me-not, but can also be wrapped in dead leaves or overhanging grass leaves. It is necessary to unwrap a folded leaf to identify the egg. This interference increases the risk of predation for the egg therefore once an egg was found the use of this technique ceased. Fifteen minutes egg searching effort per 50m of edge of the waterbody was undertaken up to a maximum of 30 minutes for waterbodies of 100m or greater.
- **Torchlight Survey –** The perimeter of each waterbody (where accessible) was walked at night after dark. The bottom of the waterbody was searched with a powerful torch and sightings of smooth newts were recorded. If present, and given sufficient water clarity, adult smooth newts can be seen using this technique in the shallow edges of the pond where they may be feeding, showing courtship behaviour or laying eggs. Larvae may also be seen using this method in late summer and autumn. Fifteen minutes of torching per 50m of edge was conducted up to a maximum of 30 minutes for waterbodies of 100m or more.

Surveys for the viviparous or common lizard were scoped out of the assessment due to the lack of suitable habitat for this species within the scheme assessment area.

Marsh Fritillary Euphydryas aurinia

Habitat assessments were undertaken regarding the necessity to undertake formal marsh fritillary surveys, according to the NIEA guidance note[39]. Marsh fritillary is dependent on the presence of appropriate areas of devil's-bit scabious *Succisa pratensis* which is the food plant for this species. All areas of semi-improved and marshy grassland were surveyed to assess the presence and extent of this species.

White-clawed Crayfish Austropotamobius pallipes

The necessity for a formal white-clawed crayfish survey was scoped with NIEA. Formal surveys have been scoped out due to the lack of evidence of white-clawed crayfish in the area, including the absence of biological records and general unsuitability of the watercourses.

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[37] Williams, P., Biggs, J., Barr, C.J., Cummins, C.P., Gillespie, M.K., Rich, T.C.G., Baker, A., Baker, J., Besley, J., Corfield, A., Dobson, D., Culling, A.S., Fox, G., Howard, D.C., Luursema, K., Rich, M., Samson, D., Scott, W.A., White, R., & Whitfield, M.,
Lowland Pond Survey. Department of Environment, Transport and the Regions, 1998.
[38] Beebee, T.J.C., Habitats of the British amphibians (4): Agricultural lowlands and a general discussion of requirement. Biological Conservation, 1981, 21; 127-139.
[39] Devil's Bit Scabious *Succissa pratensis* Survey – Specific Requirements. Northern Ireland Environment Agency, April 2010.

Fisheries

A fisheries assessment was undertaken by Ecofact Environmental Consultants under sub-contract to Arup during July 2010. A qualitative assessment of fisheries habitat 100m upstream, at the point of the works and at least 500m downstream of works was undertaken on all watercourses likely to be affected by the scheme. Habitat assessment followed the Environment Agency's 'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003' (EA 2003) and the Department of Agriculture for Northern Ireland's advisory leaflet 'The Evaluation of habitat for Salmon and Trout'. General habitat quality for macroinvertebrate communities was rated as being Optimal, Suboptimal, Marginal or Poor with reference to a scheme developed by Barbour & Stribling[40].

A secondary quantitative assessment of key sites downstream of the scheme was also undertaken to provide a robust baseline for future monitoring. This comprised a series of transect surveys across the river recording a number of factors at 30cm intervals across watercourse. The factors recorded included the depth (at low flow), velocity, a substrate score (roughness), particle size (core samples of loose substrate taken and analysed for particle size). Two control sites in watercourses not impacted by works were also surveyed in the same way. Sediments were sampled with a McNeil type sampler and sieved and weighed in the laboratory.

Benthic macroinvertebrates were sampled qualitatively using kick-sampling (Abel 1996)[41]. Specimens were identified using a series of keys. A range of biotic indices were derived including the Quality Rating (Q-value) System (Toner *et al*. 2005)[42], the NIEA General Quality Assessment (GQA), Trent Biotic Index (Woodiwiss 1964)[43], the revised Biological Monitoring Working Party (BMWP) scheme (Walley and Hawkes 1997)[44], and Juvenile Salmonid Food Index (Rabenil *et al*. 2005)[45].

Electrical fishing assessments were undertaken at selected sites under licence from DCAL under Section 14 of the Fisheries Act (Northern Ireland) 1966. The purpose of this survey was to provide information on the presence of fish species listed on Annex II to the Habitats Directive (i.e. lampreys and salmon) and other fish (i.e. brown trout and eels) present in the affected watercourses. The methodology followed Crozier & Kennedy 1994[46] and Winstone 1993[47] and

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[40] Barbour, M.T. and Stribling, J.B. (1991) Use of Habitat Assessment in Evaluating the Biological Integrity of Stream Communities. *In: Methods in Stream Ecology (Eds. Hauer, F.R. and Lamberti, G.A. Academic Press.*

[41] Abel, P.D. (1996) Water Pollution Biology. Second Edition. Taylor and Francis. England.

[42] Toner, P., Bowman, K., Clabby, K., Lucey, J., McGarrigle, M, Concannon, C., Clenaghan, C., Cunningham, P., Delaney, J., O'Boyle, S., MaCarthaigh, M., Craig, M., and Quinn, R. 2005. Water Quality in Ireland 2001-2003. Environmental Protection Agency, Wexford.

[43] Woodiwiss, F.S. 1964 The biological system of stream classification used by the Trent River Board. Chem. Ind., 11, 443-447.

[44] Walley W. J. and Hawkes H.A. (1997) A computer-based development of the Biological Monitoring Working Party score system incorporating abundance rating, biotope type and indicator value. *Water Research*, **31** (2), 201-210.

[45] Rabenil, C.F., Doisy, K.E. and Zweig, L.D. (2005) Stream invertebrate community functional responses to deposited sediment *Journal of Aquatic Sciences*. 67(4):395-402.

[46] Crozier, W.W. and Kennedy G.J.A. (1994) Application of semi-quantitative electrofishing to juvenile salmonid stock surveys. Journal of Fish Biology, 45,
159-164.

utilised a Smith Root LR-24 backpack electrical fishing unit. Fishing time at all sites was increased above the standard 5 minutes due to modest numbers of salmonids recorded.

The locations of the sites where sampling was undertaken are provided in Table 18.

Table 18 **Locations of the Sites Where Quantitative Sampling was Undertaken**

Location	**Ballynure River upstream A8**	**Ballynure River downstream A8**	**Larne at Clements Wood**	**Larne upstream of Stewartstown Bridge**	**Larne downstream of Stewartstown Bridge**	**Larne at Ballyrickard Bridge**
Habitat Assessment	✓	✓	✓	✓	✓	✓
Macro-invertebrate sampling	✓	✓	✓	✓	✓	✓
Electrical fishing	✓	✓	-	✓	✓	✓
Sediment sampling	✓	✓	✓	✓	✓	✓

Other Species

Other ecological features of note such as species listed on the UK Biodiversity Action Plan (UKBAP) and Northern Ireland BAP have been recorded as incidental records during the course of the ecological surveys.

8.4.2.3 Evaluation of Ecological Features

The ecological resources and features present on the site are assigned values according principally to their biodiversity value, plus any social, community or economic value that can be attributed to them, and their legal protection status. The value or potential value of the ecological resources or feature has been determined within a defined geographical context in accordance with the Guidelines for Ecological Assessment published by the IEEM[48] and the DMRB Interim Advice Note 130/10 Ecology and Nature Conservation: Criteria for Impact Assessment. The criteria for assessing the ecological value of habitats and species are summarised in Table 19.

Table 19 **Evaluation of Habitats and Species**

Level of Value	**Habitats**	**Species**
International	Areas designated as Special Areas of Conservation (SAC), Special Protection Areas (SPA) or Ramsar sites in response to European	A large and viable population of internationally protected species, especially migratory species, which are rare within an international context.

[47] Winstone, AJ (1993) Juvenile salmon stock assessment and monitoring by the National Rivers Authority -- a review. In: Production of Juvenile Atlantic Salmon, *Salmo salar*, in natural waters., 1993, pp. 123-126, *Can. Spec. Publ. Fish. Aquat. Sc*i., No. 118.
[48] *Guidelines for Ecological Impact Assessment*. IEEM 2006 .

Level of Value	Habitats	Species
	Directives and International Conventions.	
National	Areas designated as Areas of Special Scientific Interest (ASSI), or equivalent for keys areas habitats and plant communities.	A large and viable population of internationally protected species which are regularly occurring but scarce within an international context. Rare in a national context.
Regional	Areas of habitat of suitable size and quality to be considered for notification as ASSI. Extensive areas of UK Biodiversity Action Plan (BAP) Priority Habitats.	A large and viable population of nationally rare or protected species. Significant populations of UK BAP Priority species and legally protected species. Rare within a regional context.
County	Designated sites including: Sites of Local Nature Conservation Importance (SLNCIs); and Local Nature Reserves (LNRs) designated in the county or unitary authority area context. Areas of UK BAP Priority habitats and extensive areas of Local BAP habitats. Areas of Ancient woodland.	Significant population of Local BAP species and legally protected species. Notable assemblage of key biodiversity species.
Local	Designated sites including: Local Nature Reserves (LNRs) designated in the local context. Trees that are protected by Tree Preservation Orders (TPOs). Any non-designated habitat assemblage of moderate biodiversity value.	Populations/communities of species considered to appreciably enrich the habitat resource within the local context (such as veteran trees), including features of value for migration, dispersal or genetic exchange. Few individuals of a regularly occurring species of local interest or biodiversity interest.

In addition to these criteria some habitats and species may be of value within the context of the site and its immediate surroundings. Within this assessment these will be referred to as 'Within Immediate Zone of Influence'.

The evaluation of bat roosts and foraging areas has been undertaken in accordance with the recent guidance set out in Wray et al., 2010[49].

8.4.3 Methodology for Assessment of Effects due to Construction

The significance criteria and approach to assessment have been developed to specifically assess the significance of effects on ecological receptors, based on IEEM guidance. The scale at which the effect is considered significant will be determined according to the value of the receptor/resource and the magnitude of the impacts.

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[49] Wray S., Wells D., Long E., and Mitchell-Jones T. *Valuing Bats in Ecological Impact Assessment*. IEEM In Practice No. 70, December 2010.

The magnitude of effects are characterised according to the criteria detailed in Table 10.

An ecologically significant impact is defined as '*an impact (negative or positive) on the integrity of a defined site or ecosystem and/or the conservation status of habitats or species within a given geographical area*' (IEEM, 2006). The potential for impacts to result in significant effects on the ecological features present within or in proximity to the application site is determined in line with the matrix adapted from DMRB Volume 11, Section 2, Part 5 HA 205/08, 'Determining Significance of Environmental Effects', which compares the value of the feature with the magnitude of the impact (see Table 20).

Table 20 **Significance of Effects**

Magnitude of Impact	**Value of Receptor**				
	International	**National**	**Regional**	**County**	**Local**
Major	Significant	Significant	Significant	Significant	Significant
Moderate	Significant	Significant	Significant	Significant	Not significant
Minor	Significant	Significant	Not significant	Not significant	Not significant
Negligible	Not significant	Not significant	Not significant	Not significant	Not significant

8.4.4 Methodology for Assessment of Effects due to Operation

The methodology for the assessment of effects from operation of the proposed dual carriageway is the same as the methodology for assessment of effects from construction. Although the impacts are very different for operation, the evaluation of the ecological receptor, characterisation of effect and determination of significance are achieved in the same way.

8.5 Limitations and Assumptions

8.5.1 Limitations

The findings presented in this study represent those at the time of survey and reporting, and data collected from available sources. Ecological surveys are limited by factors which affect the presence of plants and animals, such as the time of year, migration patterns and behaviour. The ecological survey therefore has not produced a complete list of plants and animals present at the site. Nevertheless, the results of the ecological survey allow evaluation of nature conservation value, assessment of the significance of potential impacts that may arise from the proposals and consideration of appropriate mitigation measures. Every effort has been made to ensure that the findings of the assessment present as accurate an interpretation as possible of the status of flora and fauna within the scheme assessment area.

In general weather conditions during the surveys were good. However, conditions such as strong winds and persistent rain were encountered. This is not thought to have affected the findings as repeat visits were undertaken where necessary.

It is considered unlikely that any main, annex or subsidiary badger setts have been overlooked during the survey. However, the presence of outlier setts in some areas could not be confirmed, due to either a lack of sett activities (making it hard to find), discrete location or small spoil heaps associated with a single or two hole setts.

Repeat bat surveys could not be undertaken for some of the roosts due to restrictions on access by the owners of the properties involved. However, this is not likely to have affected the results.

8.5.2 Assumptions

It is assumed that distribution and/or abundance of species or habitats will remain stable between now and the years of opening and construction.

Land use changes such as intensification of farming may result in a decrease in species diversity, whilst numbers of certain species may increase if no constraints are present.

The assessment of impacts has been undertaken on the assumption that all the measures included within the environmental design will be included in the detailed design and construction of the scheme.

8.6 Baseline Conditions

The findings of the desk study and surveys undertaken are described below and should be read in conjunction with the drawings in **Appendix C, ES Volume II** that show the locations of the ecological features mentioned in the text.

8.6.1 Designated Sites

No European or statutory designated nature conservation sites occur within 2km of the proposed scheme.

There are six sites which are of local nature conservation significance within 2km of the proposed scheme:

- Carndoo Woodland identified in the Larne Area Plan 2010 where hazel and downy birch are the main tree species. Eared willow, bird cherry, hawthorn, ash and blackthorn are also present;
- Carndoo Marsh which is of conservation value for butterflies (particularly Marsh Fritillary);
- Taits Hill / Thorny Hill which is of conservation value for rare plants, including:
    - Greater butterfly orchid *Platanthera chlorantha*;
    - Small-White orchd *Pseudorchis albida*; and
    - Wood bitter-vetch *Vicia orobus*.

- Clements Woodland which is managed by the Woodland Trust and consists of wetland fields and woodland. The woodland lies to the east of the existing A8 at Tait's Hill. The 10 acre site is partly wetland and fields running alongside the Larne River. The Woodland Trust have planted over 3000 oak trees and created a pond area within the site, which also contains mature beech, ash, elder and sycamore;
- Kilwaughter Castle, an area identified in the Larne Area Plan 2010. Situated within the general vicinity (although lying outside the scheme assessment area) this site includes areas of long established woodland, a number of waterbodies and an area of ash and hazel woodland; and
- Mackeystown has two areas of hazel woodland interspersed with species rich wet grassland.

Of these only Clements Woodland is likely to be affected by the proposed scheme. This site is of county value.

8.6.2 Biological Records Search

The results of the biological records search undertaken by the CEDaR identified a selection of protected species within the A8 scheme assessment area. The Northern Ireland Bat Group (NIBG) provided records of bats. Table 21 lists the key species recorded.

Table 21 **Key Legally Protected and Notable Species Recorded Within the Scheme Assessment Area**

Group	Species	Latest Record Date	Location of Records
Plant	Japanese knotweed *Fallopia japonica*	1999	Ballynure
Invertebrate	Marsh Fritillary *Eurodryas aurinia*	1989	1km north-east of Ballynure
Fish	Brown Trout *Salmo trutta fario*	2001	Six Mile Water; Larne River
Fish	Atlantic Salmon *Salmo salar*	1995	Six Mile Water
Bird	Kestrel *Falco tinnunculus*	1997	Ballyboley Forest
Bird	Merlin *Falco columbaris*	2005	Ballyboley Forest
Bird	Hen harrier *Circus cyaneus*	2005	Ballyboley Forest
Bird	Short-eared owl *Asio flammeus*	1999	Ballyboley Forest
Bird	Buzzard *Buteo buteo*	2004	Ballyboley Forest
Mammal	Otter *Lutra lutra*	2002	These records included an otter slide on Six Mile Water and a possible otter pathway in long marshy grassland habitat on the bank of Castle Water.
Mammal	Pipistrelle species	2003	Ballyclare

Group	Species	Latest Record Date	Location of Records
	Pipistrellus sp		
Mammal	Leisler's bat	1989	Drumadowney Road
Mammal	Pipistrelle roost	1996	2km south-east of A57 junction
Mammal	Common pipistrelle	2003	Ballynure north of Church Road
Mammal	Pipistrelle	1987	North of Ballynure
Mammal	Badger *Meles meles*	2002	Ballybracken Td., 1km north-east of Ballynure; Lowtown Td., 0.5km south of Kilwaughter

8.6.2.1 Herpetofauna

No records for smooth newt *Lissotriton vulgaris* or viviparous lizard *Zootoca vivipara* have been received from CEDaR.

8.6.2.2 Marsh Fritillary Butterfly

Information obtained from CEDaR identified a record for the marsh fritillary butterfly; however the record dated from 1989.

8.6.2.3 Fisheries

Data received from CEDaR confirmed that the river systems and their tributaries contain salmonids, principally trout. Consultation with the DCAL Inland Waterways and Fisheries also highlighted the importance of minor tributaries for spawning and local fishing.

8.6.3 Field Survey

8.6.3.1 Phase 1 Habitat Survey

The Phase 1 Habitat Survey identified the following habitat types within the survey corridor which are mapped on **Drawings A8-S3-3000 to A8-S3-3009**, **Appendix C, ES Volume II** (Target Notes referred to are provided in **Appendix C, ES Volume II**):

- Semi-natural broadleaved woodland;
- Plantation broadleaved woodland;
- Plantation coniferous woodland;
- Mixed plantation woodland;
- Dense/continuous scrub;
- Improved grassland;
- Standing water;
- Running water;
- Marshy grassland;

- Bare ground;
- Amenity grassland;
- Species poor field boundaries;
- Introduced shrub;
- Broad-leaved scattered trees;
- Scattered scrub;
- Arable;
- Bare ground; and
- Tracks/roads.

The majority of land along the route is improved grassland used for livestock grazing. This kind of plant community is characterised by coarse, weedy vegetation and is likely to be of conservation value within the context of the route only.

In addition to the mature trees at Clements Wood, three areas within the scheme assessment area have mature trees or hedgerows which are classed as regionally important. These are located at Bruslee, where a Tree Preservation Order (TPO) exists on the trees along the watercourse; a mature hedgerow at Green Road; and a double treeline with a dry ditch at the A57 junction. Other potential areas of nature conservation value within the general vicinity of the scheme assessment area include river corridors and associated vegetation including the Six Mile Water, Ballynure Water and the Larne River and their tributaries.

The habitats have been evaluated for their nature conservation importance which is given in Table 22.

Table 22 **Evaluation of Habitats Present Along the Proposed A8 Dualling Corridor**

Habitat	Features/Comments	Importance
Semi-natural broadleaved woodland	Mature trees. Potential for breeding birds, terrestrial invertebrate habitat, bat roosts and for badgers to be present foraging, buildings setts. UKBAP Habitat.	County
Marshy grassland	Medium species diversity. May have a supporting value e.g. buffering water courses from effects of other land use such as agricultural runoff. UKBAP Habitat.	County
Species-poor hedgerows	Connectivity of habitat. Potential for breeding birds, terrestrial invertebrate habitat, bat roosts and flight lines, and for badgers to be present foraging, buildings setts. Could constitute UKBAP Habitat.	Local
Running water	Tributary rivers and streams. Potential for salmonid species to spawn and migrate, breeding birds and riparian bird species to be present, potential for otters to be present foraging, breeding and resting, potential for bat foraging.	County
Standing	Potential for smooth newts.	Local

Habitat	Features/Comments	Importance
water	Potential for bat and bird foraging.	
Mixed plantation woodland	Mature trees. Potential for breeding birds, terrestrial invertebrate habitat and for badgers to be present foraging, buildings setts.	Local
Plantation coniferous woodland	Mature trees. Potential for breeding birds, terrestrial invertebrate habitat and for badgers to be present foraging, buildings setts.	Local
Plantation broadleaved woodland	Mature trees. Potential for breeding birds, terrestrial invertebrate habitat and for badgers to be present foraging, buildings setts.	Local
Dense scrub	Potential for breeding birds, terrestrial invertebrate habitat and for badgers to be present foraging, buildings setts.	Within the context of the route
Scattered scrub	Potential for breeding birds, terrestrial invertebrate habitat and for badgers to be present foraging, buildings setts.	Within the context of the route
Improved grassland	Low species diversity. May have a supporting value e.g. buffering from effects of other land use such as agricultural runoff.	Within the context of the route
Arable	Low species diversity.	Within the context of the route
Amenity grassland	Low species diversity.	Within the context of the route
Bare ground	Unvegetated areas.	Within the context of the route
Track/Road	Developed area.	Within the context of the route

8.6.3.2 National Vegetation Classification (NVC) Survey

The key habitats of interest within the scheme assessment area were marshy grassland including the species *Holcus lanatus - Juncus effusus* rush pasture. These areas are shown on **Drawings A8-S3-3000 to A8-S3-3009, Appendix C, ES Volume II**. This type of wet grassland community (when in good condition) can be considered as flood plain grazing marsh, a priority BAP habitat in Northern Ireland. One of the aims of the Action Plan for flood plain grazing marsh is to maintain the total extent of this habitat, ensure a favourable condition for stands of the habitat outside of ASSIs and to restore a further 100ha by 2020.

Most of the areas of this type of rush pasture community along the route are relatively small and isolated, which means that their conservation value is likely to be limited compared with larger examples of the habitat. The larger areas of rush pasture are likely to be of importance as habitat for breeding and wintering birds and for invertebrates. The nature conservation value of this community is assessed as county for the larger areas of this habitat.

Other areas of marshy grassland included the *Epilobium hirsutum* community and *Juncus effusus-Ranunculus repens* sub-community, which is a species poor community common to wet ditches and pastures. It is often found in areas of nutrient enrichment and thus areas in which this community is present may have been subject to agricultural improvement. The nature conservation value of this community is assessed as county.

8.6.3.3 Controlled Plants

Japanese knotweed *Fallopia japonica* was identified at three locations near the existing A8; at Bruslee, south of Glen Road and at the Ballyrickard Road junction. These locations are shown in **Drawings A8-S3-3000 to A8-S3-3009, Appendix C, ES Volume II**. This species is listed in the Part II of Schedule 9 to The Wildlife (Northern Ireland) Order 1985 (as amended) as an invasive species, which makes it an offence to plant or otherwise cause to grow in the wild. As a result measures must be taken to prevent it from being spread during construction or maintenance of the scheme described in chapter 8.9.3.

8.6.3.4 Mammals

Otter

The surveys have recorded signs of otters in a number of locations, with the highest concentration of signs found on the River Larne and Six Mile Water corridors. Spraints and footprints were located in prominent areas on the banks of these rivers and their tributaries.

Water body descriptions of each of the rivers and streams within the survey corridor are provided in **Appendix C, ES Volume II**. Of the watercourse crossings surveyed beneath the existing A8, all had potential to facilitate otters crossing. However, there was no specific provision for otters to do so in high flow periods. This may well force otters to go over the A8 in high flow periods and put them at risk of road collisions.

Otter signs recorded during the course of the surveys are provided in

Table 23 and shown on **Drawings A8-S3-3020 to A8-S3-3029, Appendix C, ES Volume II (**Target Notes referred to are provided in **Appendix C, ES Volume II)**.

Table 23 **Otter Activity along the Proposed Scheme**

Location	Signs
Ballylinny Burn	Spraints and prints
Ballynure Water	Holt and spraints
Larne River	Spraints
Glen Burn	Holt and spraints

Sprains were found on rocks and bridge decks over the Ballylinny Burn to the south of the scheme, and near the bridge over the Ballynure Water. At Ballynure Water two possible holts were found, one of which would be lost to the scheme. Along the Larne River spraints were found on most suitable rocks, indicating high levels of otter activity. At Glen Burn a holt was found approximately 600m downstream of the existing A8.

There is potential for this species to use the length of the River Larne and Six Mile Water corridors and their associated tributaries throughout the survey area. Many areas of bank and associated suitable habitat exist which may provide locations for holts and sheltered resting places even in high water flow periods. For example, the woodlands and areas of scrub bordering the Larne River are excellent locations for 'couches' or holts to be situated. Although no holts were found within these areas, this may be due to the difficulty of locating these discrete and often well hidden features.

Due to their large territory size, frequently over 20km, the population of otters within the scheme assessment area is considered to be fairly low. This ecological feature is therefore considered to be of county importance.

Bat Species

A total of seven bat roosts were found to be present within buildings close to the proposed route. This includes five confirmed roosts and two possible roosts, which are considered as confirmed roosts for the purposes of this assessment under the precautionary principle[50]. None of the buildings which are under the footprint of the road were found to contain bat roosts.

The roosts found contained only small numbers of bats. It is considered likely that maternity roosts of both common and soprano pipistrelle bats are present within the general area of the proposed scheme and in particular the town of Ballynure, but outside the scheme assessment area. Approximate roost locations identified during the surveys and numbers of each species are provided in Table 24Table 24 (more details can be found in **Appendix C, ES Volume II**). Further details on the locations of these roosts are provided in **Appendix C, ES Volume II (Drawings A8-S3-3040 to A8-S3-3049)**. The field results report from Dr Kerry Crawford is also provided in **Appendix C, ES Volume II**.

Table 24 **Approximate Locations of Bat Roosts Found During Surveys**

Chainage (Ch)	Species	Number of Individuals	Roost Status
0+950	Common pipistrelle	2	Confirmed
1+100	Soprano pipistrelle	1	Possible
4+800	Common pipistrelle	2	Confirmed
5+800	Soprano pipistrelle	1	Confirmed
6+800	Common pipistrelle	2	Confirmed
7+100	Common pipistrelle	1	Possible
7+500	Common pipistrelle	3	Confirmed

The roost sites which have been identified are considered to be local and county importance.

Drawings A8-S3-3040 to A8-S3-3049 (Appendix C, ES Volume II) show the bat activity recorded during the transect surveys and the locations of the Anabats which were situated overnight. Anabat results for each location are provided in

[50] The principle that authorities should act prudently to avoid the possibility of irreversible environmental damage in situations where the scientific evidence is inconclusive but the potential damage could be significant.

Appendix C, ES Volume II. The general level of bat activity within the scheme assessment area was considered to be relatively low with only small numbers of bats encountered during both the transect surveys and the static monitoring. Species recorded during the surveys included common pipistrelle, soprano pipistrelle, Leisler's bat, Daubenton's bat and whiskered bat.

Bats were recorded foraging and flying along many of the hedgerows crossed by the proposed scheme. No significant flight lines or foraging routes were encountered except at the A57 junction (Anabat Location 7, Chainage 4+700) and the River Larne (Anabat location 14, Chainage 12+900). Almost 300 common pipistrelle passes were recorded at the A57 junction over the period of one night, indicating an important foraging site at this location, possibly connected to the roost. A significant number of bat passes were recorded at the River Larne location indicating a high level of bat activity and a likely important foraging area for common pipistrelle and Daubenton's bats; both of which were recorded passing in excess of 250 times over the period of a night. Additionally soprano pipistrelle and whiskered bats were recorded passing over the River Larne 40 times and 13 times respectively.

The populations of bat species found within the area are relatively low with the exception of the numbers of bats foraging at the A57 junction and over the River Larne. The value of the foraging areas and commuting bats is considered to be of Local to County importance..

Badger

Badger signs recorded during the course of the surveys are shown on **Drawings A8-S3-3020 to A8-S3-3029, Appendix C, ES Volume II (**Target Notes referred to are provided in **Appendix C, ES Volume II)**. The field surveys identified badger activity throughout the scheme assessment area. During the surveys a number of badger signs were discovered, including setts, paths, latrines, footprints and two badger road casualties. As expected, setts were recorded in drier areas of the assessment area where the animals have more suitable substrate for sett excavation. Additionally, sett locations were generally within close proximity to suitable foraging habitat such as hedgebanks and woodlands.

Setts recorded were concentrated in two main locations, which is likely to represent two badger clans. A main sett was located to the south of Ballynure near the A57 junction, with evidence of recent digging and foraging activity around the fields. To the north of Ballynure badger activity was discovered between Lismenary Road and Ballygowan Road, with a concentration of disused setts around Ballybracken Road. Of the setts found, only the one to the south of Ballynure was classified as a main or well-used sett. However, all have the potential to be used intermittently throughout the year as the badgers move around their territories.

Badgers have been recorded on both sides of the A8 and a number of paths/'push-throughs were recorded, where the animals cross this main road. Aside from the paths recorded, badgers may also cross the road at other locations where farm gates or tracks present easy crossing points for them, however evidence of these crossings was not observed due to lack of field signs at these locations. Recent badger footprints were recorded between Rushvale Road and Calhame Road, which were thought to have been from a badger clan to the east of the existing A8. No setts were found within this area.

One road casualty of an adult badger was recorded on the verge of the A8 near the setts to the north of Ballynure, the other was found along Lisglass Road.

This species is valued at a local level as national badger populations are relatively high, their legal protection having been afforded largely due to the history of persecution of this species.

8.6.3.5 Ornithology

Breeding Birds

Breeding birds recorded during the surveys are shown on **Drawings A8-S3-3010 to A8-S3-3019, Appendix C, ES Volume II**. Forty-five bird species were recorded within the scheme assessment area, although not all of these were considered to be breeding. Twenty-nine of these species are of conservation concern (see **Appendix C, ES Volume II**). Only one of these species, common buzzard *Buteo buteo*, is protected under Schedule 1 to the Wildlife (Northern Ireland) Order 1985.

The majority of breeding passerines and corvids were recorded in and around the farmland where the habitats included buildings, mature deciduous trees and species poor hedgerow, all providing suitable nesting locations. Improved grassland, although the most common habitat present, was being used for foraging as opposed to breeding. Buzzards were seen soaring mainly over farmland to the west of the A8 and although no signs of nests were seen, it is possible that a pair could be nesting in the local area.

Marshy grassland and surrounding rough grazing provided suitable habitat for breeding meadow pipit. Reed bunting, lesser redpoll and linnet (UKBAP species) were also found within these habitats, as well as good numbers of snipe, willow warblers and sedge warblers in the surrounding scrub.

Goldcrests, coal tits, and goldfinches were present in and around small forestry plantations and areas of scattered deciduous trees within the scheme assessment area. Small numbers of song thrushes and mistle thrushes were also recorded.

Other species present and breeding close to the road in hedgerows and scrub included the common species robin, wren, blackbird, dunnock, great tit and blue tit.

Overall the breeding bird assemblage present within in the scheme assessment area are considered to be of local value.

Barn Owls

Three barns found within the scheme assessment area were assessed for barn owl potential. These were all of stone construction with open aspects to the surrounding countryside, providing suitable locations for barn owls to roost in. No signs of roosting barn owls were found in any of the barns, and informal correspondence with the landowners suggested that barn owls were not present within the local area.

8.6.3.6 Amphibians

Waterbody descriptions are provided in **Appendix C, ES Volume II**. Six waterbodies were assessed to be potentially suitable for smooth newt due to the presence of suitable vegetation for egg laying and the presence of water during the breeding season. These were surveyed in more detail for smooth newts using a combination of visual searches during the day and torch searches after dark.

No evidence of smooth newt was recorded in any ditches/waterbodies which are likely to be affected by the scheme.

8.6.3.7 Marsh Fritillary Butterfly

Field assessments undertaken in spring/summer 2009 did not record any habitat patches or areas containing devil's-bit scabious. Additionally, no adult marsh fritillary butterflies were observed during the walkover assessment or during any of the other species surveys.

8.6.3.8 Fisheries

The descriptions of the surveyed watercourses are provided in Table 25 with an evaluation of the aquatic habitat, riparian habitat and fisheries value. The full field results report is provided in **Appendix C, ES Volume II**.

Table 25 **Watercourse Description and Evaluation**

River	**Aquatic habitat and evaluation**		**Riparian habitat and evaluation**		**Fisheries value and evaluation**		**Presence of protected aquatic species**		**Overall evaluation**
Stream at Calhame Road	Minor modified small stream. Some moss and filamentous algae present. May dry up.	E	Modified banks and poor diversity.	E	Too small to be used by fish	E	Not likely to occur	E	Low value, local importance (E)
Ballynure	Modified but retains physical diversity and moderate degree of naturalness. Biological communities indicate unsatisfactory water quality.	D	Modified banks but significant diversity and value as a wildlife corridor	C	Salmon and trout present. Production potential limited by poor water quality and imbedded substrates.	C	Atlantic salmon and Otter	C	High value, local importance (C)
Six Mile Water	Moderate degree of naturalness. Biological communities indicate unsatisfactory water quality.	D	Significant diversity and value as a wildlife corridor	C	Salmon and trout present. Production potential limited by poor water quality and imbedded substrates.	C	Atlantic salmon and Otter	C	High value, local importance (C)
Six Mile Water tributary at Ballygowan Road	Tiny stream with limited biological community. May dry up.	E	Low diversity but water source for salmonid water.	D	Too small to be used by fish	E	No likely to occur	E	Low value, local importance (E)
Larne upper tributaries near Moss Road	Very small feeder streams with limited biological communities.	E	Low diversity but water source for salmonid water.	D	Too small to be used by fish to any significant degree	D	No likely to occur	E	Moderate value local importance (D)
Upper Larne	Small size and modified status reduces ecological value.	E	Low diversity but headwaters of salmonid water.	D	Too small to be used by fish to any significant degree, but some trout are present. Angling club also stocks hatchery fish into this	D	Not likely to occur, but may be used as commuting corridor by otters	D	Moderate value, local importance (D)

River	Aquatic habitat and evaluation		Riparian habitat and evaluation		Fisheries value and evaluation		Presence of protected aquatic species		Overall evaluation
					area.				
Larne at Clements Wood	Modified channel with water quality problems.	D	Modified banks but significant diversity and value as a wildlife corridor	D	Some trout present and is upstream of trout producing areas.	C	Is probably used by Otter	C	Moderate value, local importance (D)
Larne at McCann's Quarry	Modified but retains physical diversity and moderate degree of naturalness.	D	Modified banks but significant diversity and value as a wildlife corridor	D	This is a reach used by trout for nursery and spawning purposes.	C	Otters are likely to utilise this area of the river	C	Moderate value local importance (D)
Larne upstream of Stewartstown Bridge	Degraded channelised river with unstable banks, poor in-stream diversity and unsatisfactory water quality.	D	Modified unstable banks but of value as a wildlife corridor	D	This is a reach used by trout and spawning and nursery areas are located upstream and downstream from here. However, the stretch itself is of only moderate local value to fisheries.	D	Otters are likely to utilise most of the Larne River corridor	C	Moderate value local importance (D)
Larne downstream of Stewartstown Bridge	Good physical diversity and moderate degree of naturalness. Unsatisfactory water quality.	C	Moderate diversity and value as a wildlife corridor	C	Trout present in good numbers, including 0-groups. Stretch has salmon potential and this species may return in the future. Production potential limited by compromised water quality and imbedded substrates.	C	Otters are likely to utilise most of the Larne River corridor. Potential for salmon to return to this area.	C	High value, local importance (C)

River	Aquatic habitat and evaluation		Riparian habitat and evaluation		Fisheries value and evaluation		Presence of protected aquatic species		Overall evaluation
Larne downstream of Bogtown Bridge	Good physical diversity and moderate degree of naturalness. Unsatisfactory water quality.	C	Moderate diversity and value as a wildlife corridor	C	Trout present, and salmon potential. Production potential limited by compromised water quality and imbedded substrates.	C	Otters are likely to utilise most of the Larne River corridor. Potential for salmon to return to this area.	C	High value, local importance (C)
Glen Burn	Minor small stream. Excessive filamentous algae present. Known to dry up.	E	Reasonable diversity and of some biodiversity importance.	D	Too small to be used by fish to any significant degree. However some small trout may enter from Larne.	E	Not likely to occur.	E	Low value, local importance (E)
Larne at Ballyrickard Bridge	High physical diversity and naturalness. Biological communities indicate unsatisfactory water quality.	D	Significant diversity and value as a wildlife corridor	C	Salmon and trout present. Production potential limited by imbedded substrates and sub-optimal water quality.	C	Atlantic salmon and Otter	C	High value, local importance (C)

International value (A), National value (B), Regional value (C), County value (D), Local value (E).

Overall, the populations of fish within the watercourses along the route are valued at a regional level.

8.7 Environmental Design

As detailed within chapter 5.3.1, the A8 Dualling scheme has progressed with continuous collaboration between the design team and environmental specialists. Through this process, an environmental design has been developed as an integral part of the overall scheme design. These measures have been assessed as part of the scheme and are not considered to be additional mitigation measures.

The nature conservation elements of environmental design included in the scheme design are as follows.

8.7.1 Mammals - Badgers and Otters

All guidance provided in this section follows DMRB Volume 10, Section 4, Part 2 Nature Conservation Advice in Relation to Badgers, and Part 4 Nature Conservation Advice in Relation to Otters.

8.7.1.1 Principles

- To prevent death or injury to mammals during construction and operation;
- To allow passage of mammals under/over the road safely;
- To avoid destroying/obstructing access to a mammal resting site; and
- To maintain commuting and foraging routes for mammals.

8.7.1.2 Design

Underpasses are to be provided at the locations identified within the Environmental Master plans, **Appendix M, ES Volume II**. Underpasses will be constructed of 600mm diameter concrete pipes and widened at the entrances if possible. For crossings over 20m in length, the width of the pipe will be increased to 900mm diameter. The pipes should be installed with a slight fall along their length to ensure that they remain dry at all times.

Fencing will extend for 500m either side of the crossing point and on both sides of the road to direct badgers and otters to the crossings. There should be no gaps in the fencing and care must be taken to avoid gaps where the fencing abuts structures such as over bridges. As the fencing needs to guide mammals in to the crossing point, it should be angled or recessed to funnel the animals towards the crossing.

Mammal fencing for badgers or otters as appropriate should be designed in accordance with DMRB Volume 10, Section 4. As a minimum standard, fencing should be at least 1.3m high above ground for badgers and 1.6m high for otters, with a lower section of 600mm buried below ground. 300mm of the buried return will extend down into the soil and a further 300mm turned away from the road in the direction from which mammals will approach. This will prevent mammals from digging under the fence and causing a breach. Where the fencing is to be placed on undulating ground, or where it is not possible to provide crossing points close to pre-existing pathways, it may be necessary to provide fencing buried to depths of up to 500mm with an equal length turned outwards.

Any underpasses should emerge in the fence line or hedgerow rather than in the middle of a field or open area so that the badgers can find them easily. They should not be obstructed with landscape planting but rather the planting should be used to 'soften' the approach and provide cover as the animals approach.

Underpasses located at stream and river crossings will be in the form of separate underpasses situated above the predicted flood level with the exception of the crossing of the Ballynure Water at chainage XXXX, Hillis Bridge. At his location a farm access underpass will provide a safe means of passage for otters under the road during storm events.

8.7.2 Bats

All guidance provided in this section follows DMRB Interim Advice Note (IAN) 116/08 ' Nature Conservation Advice in Relation to Bats', and 'Bats and Road Construction' published by the Road and Hydraulic Engineering Institute in 2005 (Rijkswaterstaat, the Netherlands).

8.7.2.1 Principles

- To prevent death or injury to bats during construction and operation;
- To allow passage of bats under/over the road safely;
- To avoid destroying/obstructing access to a bat resting site; and
- To maintain commuting and foraging routes for bats.

8.7.2.2 Design

Safe crossing-points would be required at the locations identified within the Environmental Master plans, **Appendix M, ES Volume II** to allow bats to fly over or under the road in order to avoid road traffic mortality and allow bats to continue to use their existing flight paths.

The crossing of the Ballynure Water should be sized to allow sufficient cross sectional area above flood levels for bats to be able to use the culvert. This would require head room of 4m over the flood level. As the culvert carrying this river under the scheme is to be located approximately 15m to the north of the existing river, a separate bat underpass measuring 4.5m high by 4m wide[51] will be constructed on the alignment of this existing river once the river diversion has been completed.

Vegetation bars or barriers ('hop-over') in the form of dense stands of vegetation would be used at three locations so that bats are guided to fly over the tall structures and not down to the traffic level. These vegetation bars need to be positioned on both sides of the traffic route. Dense native hedges or trees of at least 3m height would be planted adjacent to the traffic route for this purpose. This approach is recommended for the area around Ballynure. The purpose and

[51] Guidance set out in Bickmore Associates, 2003. *Review of Work Carried Out on the Trunk Road Network in Wales for Bats*. Transport Directorate, Welsh Assembly Government.

aim of the environmental design is to provide safe crossing points where bats are able move from one side to the other without the risk of being struck by vehicles leading to bat fatalities. This approach is seen as providing the most favourable outcome, as deterring bats from crossing the road would have the effect of habitat fragmentation and result in a decrease in the amount of suitable foraging habitat which bats could utilise, depending on the location of their roosts and their foraging areas.

Lighting of the scheme should be kept to a minimum to avoid disturbance to foraging bats and disruption of flight paths. Where lighting is required, for example around junctions, cowls or hoods should be fitted to reduce light spill.

8.7.3 Fish

Culverts will be designed to accommodate fish where necessary, including reducing their length where possible, decreasing the flow velocity of water through the culvert and creating pools above and below the culvert for fish to rest. The design of the culverts has been guided by a geomorphological assessment taking in to consideration the requirements of the Water Framework Directive.

Further details on fisheries elements of the environmental design are provided in chapter 12 'Road Drainage and the Water Environment'.

8.8 Assessment of Effects due to Construction

This section assesses the effects of the scheme with all mitigation/enhancement measures that form part of the environmental design as described in chapter 8.7 included.

8.8.1 Designated Sites

Clements Wood non-statutory site of nature conservation interest would experience the loss of approximately ten mature trees and numerous smaller hedgerow species along the boundary with the A8 to accommodate the earthworks of the proposed scheme. The extent of the land-take is likely to be 0.4ha of the site which would constitute an 11% reduction in size. Although the species present are common within Northern Ireland, the habitat loss is permanent and non-reversible, leading to a ***significant minor adverse*** effect.

The construction phase of the scheme would create an increase in noise and dust emissions. The trees and other plant species within the site may be adversely affected by this in terms of disturbance of soils and reduced air quality. These effects are probable, based on current information on the construction strategy, but are temporary for the duration of construction and reversible as the plants are likely to recover once construction activities stop. This would lead to a ***minor adverse*** effect on the remaining site, which is ***not significant***.

8.8.2 Habitats

There would be areas of direct habitat loss to allow construction of the proposed scheme (see Table 26). Direct loss of habitats would occur:

- adjacent to the existing A8 to facilitate widening of the route;

- where the scheme goes off-line at Bruslee;
- to the west of Ballynure; and
- at the proposed junctions.

In addition to the direct land-take for the carriageway there will also be areas of habitat loss resulting from construction compounds, topsoil storage, temporary settlement ponds and attenuation ponds required as part of the drainage design.

The majority of the habitats which would be affected are of local value or within the zone of influence only. They would be permanently affected; however the loss of these habitats is not significant due to their low value to nature conservation. It is estimated that 9.3ha of marshy grassland would be lost, resulting in a ***moderate adverse*** effect which is ***significant***.

Hedgerows and trees of county or local importance would be lost to the scheme. Approximately 50% of the large trees within the hedgerows at Green Road and the A57 junction would be permanently removed, resulting in a ***moderate adverse*** effect which is ***significant***.

Table 26 **Habitats Directly Impacted by the Proposed A8 Dualling**

Habitat Type	Area lost (ha)	Value
Marshy grassland	9.3	County
Plantation broadleaved woodland	0.6	Local
Plantation coniferous woodland	0.1	Local
River and riparian habitats	7.5	Local
Arable	2.8	Within the context of the route
Continuous scrub	0.8	Within the context of the route
Improved grassland	75	Within the context of the route
Poor semi-improved grassland	0.4	Within the context of the route
Amenity grassland	0.3	Within the context of the route

Construction of the proposed scheme has the potential to cause considerable disturbance to habitats away from the proposed scheme through the repeated movement of plant machinery on access routes and haul roads during construction. Effects could include direct vegetation damage and soil compaction resulting in a reduction in water infiltration for use by plants and an unsuitable growing medium for re-establishment of vegetation.

The assessment of the watercourse realignments are described in chapter 12. Realignment work would impact upon the watercourses themselves as well as the species of flora and fauna which they support. It is expected that overall no net loss of riparian habitat would be experienced during construction, as the realignment proposals aim to increase or match the area of the existing habitat.

There would also be a loss of a relatively large stretch of river and riparian habitat at the Ballynure Water Crossing. This would occur both through the loss of the river under the footprint of the scheme and the loss of stretches of the river on either side of the scheme where the Ballynure Water will be diverted to the constructed culvert 15m to the north. Overall the scheme would result in a permanent major adverse impact on river and riparian habitats which would be significant.

There is the potential for impacts upon water quality within the watercourses along the alignment during construction as a result of run-off or accidental spillage, which may adversely affect fish and otters. The impacts on water quality are assessed in chapter 12. The impacts on mammals and fish are assessed below.

Indirect effects resulting from construction include dust deposition as a result of construction activities, particularly during dry periods when the dust is not washed off the plants by rainfall. This would potentially decrease growth rates of some species. This is likely to be restricted to the construction period only and the marginally slower growth rates that could occur are not considered likely to cause a significant effect on the integrity of plant communities.

8.8.3 Controlled Plants

Japanese knotweed has been found at a number of locations along the proposed scheme. During the construction there is the potential for soils contaminated with Japanese knotweed to be transferred, causing a significant adverse effect on the local environment if no mitigation is implemented.

Excavation of Japanese knotweed contaminated soil would be required at the Ballyrickard Road junction, which again has the potential to lead to significant adverse effects on the local environment if untreated.

8.8.4 Mammals

8.8.4.1 Otters

Otter resting places have been found along the main watercourses with one located under the alignment of the route (see **Drawing A8-S3-3024, Appendix C, ES Volume II**) along Ballynure Water. The removal of this holt is likely to cause disturbance to any otter occupying it, which would result in a moderate adverse effect on a single otter. The effect of this would be significant. A licence would be required from NIEA to allow construction in this area to proceed, and would require a mitigation strategy for otters at this location which is likely to include the creation of a replacement holt at a suitable location along the Ballynure Water.

Disturbance of otter movement along watercourses is likely to occur during construction of the scheme. The presence of human activity and machinery near watercourses is likely to have a ***minor adverse*** effect on otter movement along the rivers. It is possible that noise, vibration and lighting from construction activity could cause disturbance in the surrounding area, potentially impacting on otters. However, all such impacts would be temporary in nature and are not likely to be significantly greater than existing baseline levels resulting from the existing A8. These effects would be temporary, lasting for the duration of the works around the watercourse, and affect only a few individuals.

During construction a small number of otters are at risk of death or injury from heavy machinery and deep excavations. This is unlikely to occur but would have a major adverse effect, which is significant. Additionally, if otters do use some of the smaller watercourses along the A8 during the construction period, and move towards construction activity areas, there is an increased risk of mortality of otters due to the number of construction vehicles in the area. The magnitude of the impact upon otters is assessed as ***minor adverse*** and ***non-significant*** and unlikely to occur. It would be necessary to construct the new channels for each of the proposed realignments in advance of diverting the water flow, which may cause adverse effects on otters moving through the area through disturbance and the risk of them falling into the newly created channels. The effect of the temporary loss of habitat to otters is of ***minor adverse*** significance, as it is expected that the replacement habitat would be of equal or greater value to otters. However, the disturbance and risk of injury or death are unlikely to occur but would be of ***moderate adverse*** magnitude which is ***significant***.

8.8.4.2 Bats

The construction of the proposed scheme will not result in the direct loss of any known bat roosts. However, three roosts are located within 100m of the proposed road and another one will be included within an island of land at the A57 road junction. Although significant excavations and earthworks will be undertaken near these roosts the measures included within the COCP are considered sufficient to reduce the risk of disturbance to bats within these roosts. If rock blasting is required at the A57 junction there is likely to be a moderate adverse effect in terms of disturbance on bats if they are present during these works, which is significant.

The construction of the road is likely to result in flight lines for bats from these roosts to be interrupted where the road intersects with hedgerows and stream corridors. This impact is considered likely to be ***minor adverse*** on the populations of bats which is ***not significant*** due to the inclusion within the Environmental Design of temporary artificial bat crossing points during the construction phase.

Although all bats are considered to be vulnerable to collisions with vehicles the differences in behaviour of the different species means that some species are at particular risk. The species which have been encountered during the surveys undertaken for the A8 Dualling are the common pipistrelle, soprano pipistrelle, Leisler's bat and Myotis species. Of these, the Leisler's bat is considered to be at least risk of collisions due to its tendency to hunt for prey in more open areas of habitat and fly higher above the ground than the other species. The other species encountered habitually fly at canopy height or along areas of woodland edge, hedgerows and water bodies. In urban areas, pipistrelle bats are frequently found foraging on insects attracted to streetlights. Lighting used during construction activities therefore has the potential to have the effect of attracting bats towards construction areas, which would have a ***minor adverse*** effect on bats which is ***not significant***.

It is expected that the proposed watercourse realignments would have a ***minor adverse*** effect on bat species during construction, which is ***not significant***. It is expected that the replacement habitat would be of equal or greater value to bats for foraging and navigating along.

8.8.4.3 Badgers

Badger setts have been located to the west of the A57 junction and around Ballybracken Road. At the A57 junction the construction of the road will result in the removal of a badger set. As work that disturbs a badger sett is illegal, a licence would therefore be required from NIEA to allow the construction works to proceed in this area. As part of the licence application a mitigation strategy will be required to provide an alternative replacement sett in a suitable area within the existing home range of that clan (family group) of badgers. The effect of this temporary disturbance and sett closing is considered to be of ***minor adverse*** magnitude which is ***not significant***.

At Ballybracken Road junction the proposed works areas are within 25m of three badger setts and as a result there is the potential for badgers to be affected by the noise and vibration associated with the construction of the scheme. Due to the proximity of the scheme to these setts a licence would be required for construction along with mitigation in terms of temporary sett closures or restrictions on activities at certain times of the year. It is expected that the effects on badgers at this location would be ***minor adverse,*** which is ***not significant***.

Badger habitat loss and fragmentation is likely to occur as a result of the construction of the scheme. The habitats which would be lost are predominantly common habitats which are widespread in the area, and the loss is predicted to have a ***negligible*** effect on badgers. This is likely to occur at Ballybracken Road, as badger signs were recorded on both sides of the existing A8. It was not confirmed whether these badgers were from the same clan, however due to the proximity of the signs to each other it is highly likely that they are. The effect of this fragmentation would be mitigated as part of the environmental design by providing three badger underpasses and associated badger fencing at this location. The effect of fragmentation during construction before the underpasses are constructed is considered to be ***minor adverse*** although ***not significant***.

During construction badgers are at risk of death or injury from heavy machinery and deep excavations. This is unlikely and would affect only a few individuals, however it is of ***moderate adverse*** magnitude which is ***significant***.

8.8.4.4 Ornithology

Breeding Birds

Breeding birds would be affected by loss of habitat for nesting and foraging, and increased disturbance during construction. Direct adverse effects on breeding birds would occur if vegetation clearance and construction were to occur within the bird breeding season.

There would be some direct impacts on breeding bird populations during the construction phase due to disturbance of birds through increased noise levels and vehicle movements and depending on the timing of works, potential direct loss of active nests and breeding birds. However, the potential number of birds disturbed would be relatively low in terms of the wider populations of any affected species. Any impacts due to disturbance would be temporary and of ***minor adverse*** magnitude and ***non-significant***.

Habitat fragmentation occurs when a road development imposes a barrier to the natural dispersal of animals resulting in disrupted movement across a site. Some species will not inhabit areas within several hundred metres of a road. While the barrier effect imposed by the proposed scheme to birds is difficult to assess due to it being variable between species, as a general rule, the busier and wider the road the more effective barrier it is to dispersal (English Nature, 2001).

It is considered that there are sufficient alternative foraging areas within the local area for any birds which may nest within nearby vegetation or buildings. The overall impact from the proposed works is considered to be ***minor adverse*** during construction and ***not significant***.

8.8.4.5 Herpetofauna

Smooth newt

No newts were found during the course of the surveys and although a number of the watercourses were assessed as being potentially suitable for smooth newts, no adverse effects on smooth newts are predicted.

8.8.4.6 Fisheries

Direct effects on fish are possible where the scheme crosses watercourses, and particularly where there are proposals to realign watercourses.

Whilst the local rivers systems and their tributaries contain salmonid species, principally trout, data obtained from DCAL indicates that areas with high numbers of trout and salmon lie outside of the scheme assessment area. The realignment of the River Larne is not likely to result in a significant loss of fisheries habitat as the recreated meander would be of similar size and quality. The realignment of the Ballynure Water as described in the habitats section above will result in a loss of fish habitat. It is therefore likely that there would be ***moderate adverse*** effect on salmonid species as a result of the construction of the scheme.

The overall effect on fish species is expected to be ***moderate adverse*** which is ***not significant***.

8.9 Mitigation of Effects due to Construction

8.9.1 General

During construction general control measures would be established, in addition to the species-specific advice below, to control the effect of temporary works on features of ecological value. This would take the form of a Code of Construction Practice (CoCP, chapter 5.8), and detail measures which would be adhered to for protecting the ecological resource during construction of the proposed scheme.

8.9.2 Habitats

Where areas of sensitive habitats are present in close proximity to the scheme but which are not directly affected by the land take, the presence of these areas should be communicated to the contractor and their work force through site inductions so that care is taken to avoid encroaching in to these habitats. This should also be enforced with signed fencing. This is particularly important adjacent to Clements Wood.

8.9.3 Controlled Plants

Disturbance of soils within 7m of any Japanese knotweed will require a Japanese Knotweed Management Plan to be prepared detailing how any Japanese knotweed contaminated soils will be dealt with. It is recommended that this species be treated according to published guidance. Treatment typically involves spraying the plants with glyphosate every year for a minimum of 3-5 years. If any areas of Japanese knotweed require removal, any soil material within a 7m radius of the base of each stand must be disposed of at a licensed waste landfill site in accordance with the guidelines.

8.9.4 Legally Protected Species

Pre-construction checks for legally protected species would be required, to ensure that up to date information is available for any licence applications which may be required.

8.9.5 Fisheries

To safeguard fish populations and water quality in rivers, a number of mitigation measures should be undertaken during construction. These are outlined in the CoCP, chapter 5.8.

8.10 Residual Effects due to Construction

No significant residual effects have been predicted from construction of the proposed scheme.

The residual effects of construction activities associated with the proposed scheme would be medium to low risk after mitigation and would occur on a short to medium term basis only. It is anticipated that there are no long term residual effects related to the construction of the proposed scheme.

8.11 Assessment of Effects due to Operation

This section assesses the effects of the scheme with all mitigation/enhancement measures that form an integral part of the design included.

8.11.1 Designated Sites

No effects on any designated sites are predicted.

8.11.2 Habitats

The effects of habitat loss from construction have been assessed above.

There is the potential that vegetation in the vicinity of the scheme may be affected through increased levels of airborne pollutants during operation, particularly in those areas where the scheme comes off-line. The predicted changes in airborne particles and NO_2 levels are reported as minor adverse to negligible within the Air Quality assessment (see chapter 14). The effect on plant species is therefore expected to be of ***negligible*** significance given that the vegetation communities involved are of low ecological value.

Water quality is unlikely to be affected during operation as all drainage outfalls carrying road surface runoff would be fitted with petrol interceptors to prevent waterborne pollution from entering watercourses via the outfalls of the drainage system. Any impacts are expected to be ***negligible*** in the presence of these measures.

8.11.3 Controlled Plants

During operation of the proposed scheme it is unlikely that controlled plants would need to be considered. However, if controlled plants are found growing within the soft estate of the scheme these should be treated with appropriate herbicide to eradicate them to reduce the potential constraint they would pose to maintenance operations.

8.11.4 Mammals

8.11.4.1 Otters

Otters are likely to be directly affected by the operational phase of the proposed scheme. If otters attempt to cross the new dual carriageway, there is potential for an increase in otter road-kill mortality due to faster moving vehicles and an increased number of lanes of traffic to cross. There is also the potential for increased otter mortalities as a result of collisions with vehicles as the proposed scheme would be crossing water courses and associated habitats at points not currently bisected by a road. The risk of otters being hit by road traffic is reduced due to the inclusion of otter underpasses and ledges within both existing and new watercourse crossings. These crossings have also been designed to retain connectivity of the landscape for otters and avoid any fragmentation effects that the road may cause. With the incorporated mitigation proposed, direct effects on otters are predicted to be of ***minor adverse*** magnitude and ***not significant***.

Permanent lighting associated with junctions would potentially have an indirect impact upon otters in terms of night time disturbance. Increased traffic volumes are likely to result in an increase in noise levels, which may also disturb otters. When the road is operational the additional traffic noise and vibration and road lighting is likely to have a ***minor adverse*** effect on otter movement along the watercourse. However, otters are likely to adapt to this disturbance with the provision of vegetation cover and underpasses, so the effect would be temporary and ***not significant***.

8.11.4.2 Bats

The incorporation of bat hop-overs within the environmental design of the proposed scheme is a means of ensuring continuity of bat flight lines while avoiding potential habitat fragmentation which would arise from deterring bats from crossing the scheme.

The inclusion of a bat underpass on the alignment of the existing Ballynure water channel means that bats using the river as a flight route will be able to fly through the bat underpass culvert without risking collisions with vehicles.

Although lighting is included within the design of the scheme for reason of health and safety around junctions, lighting is not being proposed as part of the mitigation for impacts on bats. Lighting has not been deemed as a suitable option for the mitigation strategy for the proposed scheme as the species involved are more tolerant to lit stretches of roads.

Lighting is required for health and safety reasons at the A57 junction during operation. It is recommended that sodium lights are used as these attract fewer insects and are therefore less likely to encourage bats to forage in close proximity to the traffic. The design of the lighting columns and lamps should seek to restrict the spill of light to the road surface and any signage and spill onto the hedgerow or hop-over planting is prevented.

Overall the effect on bats is expected to be ***minor adverse*** which is ***not significant***.

8.11.4.3 Badgers

From the number of badger paths found crossing the existing A8 and the number and location of the casualties, it can be deduced that badgers regularly cross this road. Measures to reduce the likelihood of badger casualties are incorporated into the design of the scheme, and include badger fencing and underpasses at appropriate locations. These crossings have also been designed to retain connectivity of the landscape for badgers and avoid any fragmentation effects that the road may cause. With these measures in place, the magnitude of the impact upon badgers is assessed as ***negligible*** and ***not significant***.

8.11.4.4 Ornithology

Breeding Birds

Where the proposed scheme would constitute a new off-line route through a range of habitats where no comparable road exists (at Bruslee and Ballynure) this is likely to result in an increase in mortality and is most likely to occur where birds do not have time to avoid road traffic travelling at high speed. Operation of the proposed scheme also has the potential to have significant fragmentation and isolation impacts on bird populations through a restriction in dispersal and movement of species between habitats.

Operation of the proposed scheme could result in a reduction in the abundance of invertebrate communities within the immediate vicinity of the proposed scheme and thus indirectly impact bird populations through a reduction in food availability. Removal of surrounding vegetation and buildings may alter the availability of shelter for wintering birds and nesting sites for breeding birds increasing their vulnerability to a range of external factors such as adverse conditions and/or predators. In addition, indirect habitat loss could occur in areas adjacent to the proposed road, where an increase in noise and pollution from the traffic using the road could lead to birds moving out of the area and thus rendering potentially suitable habitat as unsuitable for wintering and breeding bird populations. The extent of this effect would be along the length of the scheme, but of ***negligible*** significance.

Research undertaken by Reijnen et al. (1997)[52] and Reijnen et al. (1994)[53] has shown that road traffic noise exceeding 50dBA can reduce bird density (40 dBA for some woodland species) in adjacent habitats, while in comparison, some bird species appeared unaffected by disturbance but had lower breeding success (COST 341, 2003[54]). Increased traffic volumes are likely to result in an increase in noise levels, which may displace contiguous bird breeding territories. The noise assessment (see chapter 13) reports the predicted changes in noise levels. As expected, the greatest changes in noise level are where the scheme is off-line, however this does not exceed the threshold levels likely to cause disturbance to breeding birds. Similar bird nesting habitat occurs in adjacent areas and the any effects are considered to be permanent, ***negligible*** and ***not significant***.

8.11.5 Fisheries

Culverts under the road for the tributaries of main rivers and other streams have been designed to allow fish to pass through. The effect on fish during operation is therefore expected to be ***negligible.***

8.12 Mitigation of Effects due to Operation

As part of the general aftercare period all measures which have been included within the environmental design should be regularly checked to ensure their continued effectiveness.

The fisheries sites will be surveyed again post construction to look for any significant changes in the transect survey score and changes in percentage of fine particles in substrate core samples.

8.13 Residual Effects due to Operation

No significant residual effects have been predicted from operation of the scheme.

8.14 Cumulative Effects

There are a number of relatively small developments proposed along the proposed scheme, some of which are already approved. The majority of these involve construction on previously developed land or on low quality habitats such as improved grassland, and as such are not expected to have a significant impact on the ecological resource within the area.

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[52] Reijnen, R., Foppen, R. & Veenbaas, G. (1997) Disturbance by traffic of breeding birds: evaluation of the effect and considerations in planning and managing road corridors. *Biodiversity and Conservation*, **6**, 567–581.
[53] Reijnen, R., Foppen, R., Braak, C.T., Thissen, J. (1994) The Effects of Car Traffic on Breeding Bird Populations in Woodland. III. Reduction of Density in Relation to the Proximity of Main Roads *Journal of Applied Ecology*, Vol. 32, **1**, 187-202
[54] Damarad, T. and Bekker, G.J., 2003. COST 341 - Habitat Fragmentation due to Transportation Infrastructure: The Final Report. Office for official publications of the European Communities, Luxembourg.

Cumulative effects with other environmental disciplines have been considered within the relevant receptor assessments.

8.15 Enhancement Opportunities

There is the potential to enhance the habitats within the area through planting, seeding and appropriate habitat management. Specific areas for this enhancement are provided on the Environmental Masterplans, **Appendix M, ES Volume II**. However, no planting should take place within any marshy grassland habitats.

Roost boxes for bats should be provided on trees and buildings within the area. Bat bricks would be incorporated within bridges where these are to be modified or newly constructed.

Similarly, bird nest boxes should be provided on trees and buildings within the area, particularly where trees and scrub habitat have been removed. This would ensure that nest sites are available for a range of breeding bird species.

9 Landscape

9.1 Introduction

This chapter presents an assessment of the effect on the landscape and visual resource within the scheme assessment area as a result of upgrading a 14km stretch of the A8 Belfast to Larne Road from Coleman's Corner to the B100 (Ballyrickard Road), from single carriageway to dual carriageway standard.

In accordance with DMRB, the predicted effects that could arise during construction, operation and the design year have been identified. The proposed mitigation measures have been developed in collaboration with other disciplines, combining the overall environmental objectives to achieve an integrated and appropriate landscape treatment proposal. This assessment takes account of the measures incorporated in to the design proposal to mitigate the effects of the A8 Dualling scheme.

9.2 Legislation and Guidance

The guidance documents used to inform the methodology for the assessment of landscape and visual effects is described in chapter 9.4 'Assessment Methodology.'

A framework of national and local legislation and planning policy guidance exists to protect and conserve the landscape environment. These are listed within chapter 17 'Policies and Plans'. These together with the following sources of guidance have been used in inform the landscape and visual impact assessment and develop an appropriate landscape treatment proposal:

- The Design Manual for Roads and Bridges (DMRB) Volume 11:
  - Section 2, Part 5, HA/205/08 Assessment and Management of Environmental Effects;
  - Section 3, Part 5, Landscape Effects;
- Guidelines for Landscape and Visual Impact Assessment (GLVIA). The Landscape Institute/ Institute of Environmental Management and Assessment. Second Edition (2002);
- The Countryside Agency, Landscape Character Assessment – Guidance for England and Scotland, Topic Paper 6: Techniques and Criteria for Judging Capacity and Sensitivity (2004);[55]
- The Countryside Agency Landscape, Access, and Recreation – Including Landscape in Road Design, Construction and Mitigation and Good Practice Discussion Note;[56]
- Northern Ireland Landscape Character Assessment 2000 (NILCA); and
- Road Services Northern Ireland Environmental Handbook.

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55 Guidance note that explores the current thinking within the landscape profession about the assessment of landscape sensitivity. Alongside DMRB and GLVIA, this guidance has been used to inform the A8 landscape methodology.
56 A good practice discussion note on integrated road schemes into the landscape. The case studies refer to rural projects with integration techniques applicable to the A8 Dualling scheme.

9.3 Scoping and Consultation

9.3.1 Scoping

An ES Scoping Report was issued in March 2010 to key statutory and non-statutory bodies outlining the approach, methodology, baseline conditions and expected effects of the scheme.

It was circulated to all stakeholders, offering them an opportunity to address the proposed methodologies for the EIA or to address issues that have not been adequately covered. A list of consultees is included in chapter 7.3.

The main purpose of the scoping report in terms of the Landscape and Visual Impact Assessment (LVIA) was to detail the approach to be undertaken including:

- To inform consultees of the assessment process and LVIA methodology;
- To inform consultees of the anticipated scheme assessment area;
- To outline the landscape and visual baseline conditions;
- To record the predicted landscape and visual effects;
- To set out a series of key landscape and visual mitigation principles; and
- To seek comment on the above from the consultees.

A summary of the scoping process and wider consultation is provided within chapter 7.

9.3.2 Consultation

Liaison with statutory consultees has taken place throughout the scheme design of the A8 Dualling. A list of stakeholders consulted and a summary of key issues discussed during the process is presented in chapter 7.3 and 7.4.

9.4 Assessment Methodology

The methodology for the LVIA is outlined in the following sections and describes the process by which landscape and visual effects have been identified.

The methodology adopted for the assessment of landscape and visual effects follows the current DMRB[57] guidance (published June 1993) and seeks to reflect current best practice in the assessment of landscape and visual effects as set out in the documents listed in chapter 9.2.

57 The current DMRB Guidance of Volume 11, Section 3, Part 5, Landscape Effects, is currently under review.

9.4.1 Methodology for Establishing Baseline Conditions

9.4.2 Landscape Baseline Conditions

9.4.2.1 Landscape Receptors and Characteristics

This part of the assessment identifies and describes the baseline conditions that comprise the landscape receptors, including a factual description of topography, land use, pattern, scale, settlement and transport routes.

The assessment area for the landscape receptors focuses on the immediate corridor of the proposed A8. Landscape receptors beyond this corridor are considered unlikely to be directly affected by the proposals. For example, existing hedgerows would not be affected beyond the construction area and the effects resulting from the diversion of utilities would be localised, small scale and subject to detailed design by the relevant statutory utilities.

Areas beyond the assessment area that are considered to be of special landscape merit such as local, regional or national designations are recorded. Cultural heritage associated with the landscape may also be noted where relevant.

9.4.2.2 Landscape Character Areas (LCAs)

Through the evaluation of the landscape receptors and landscape characteristics, the baseline study seeks to define areas of landscape character. Landscape character assessment seeks to divide the landscape into distinct, broadly homogenous units with defining characteristics. In this way each character area should be distinct from an adjoining area which will be defined by a different set of key parameters.

LCAs (as defined further in chapter 9.6.3) are generally defined by local planning authorities, in Northern Ireland this has been undertaken by the NIEA in association with the Planning Service. The landscape baseline refers to existing documentation relating to landscape character in order that pre-defined character areas are used as the basis for this assessment.

The Northern Ireland Landscape Character Assessment (NILCA) has identified a total of 130 distinct LCAs within Northern Ireland, five of which are relevant to this study. These are broad assessments of the existing landscape character for the Province. For each LCA a description and analysis of the key characteristics have been provided together with a record of notable features and typical viewpoints.

The landscape baseline data has been assembled through a combination of desk study and field surveys. The desk study includes a review of existing documentation and captures designated areas within the scheme assessment area. Any landscape receptors that are considered to contribute to landscape character have been recorded through the study of aerial photographs and topographical survey information, supported by field surveys. Field surveys commenced in December 2009 and continued at intervals throughout 2010.

9.4.2.3 Landscape Sensitivity

Landscape sensitivity is a measure of the capacity of the landscape to accommodate change resulting from a development. It identifies the vulnerability of each LCA to the introduction of new features, such as road schemes in a rural setting or the loss of existing features or specific landscape receptors.

The value of the landscape is derived from those key features and elements which collectively or individually define the landscape character and the importance that society attributes to those features.

In accordance with DMRB guidance[58], the evaluation of landscape value is closely related to the concept of sensitivity to change and is defined using a five point scale as indicated in Table 1, **Appendix D1, ES Volume II**.

Attributes which may contribute to the sensitivity of the landscape include:

- Landscape receptors that contribute to the landscape character (hedgerows, existing woodland, watercourses etc);
- Landscape character including aesthetic considerations;
- Landscape features that are commonplace/ rare/ distinctive;
- Visual enclosure/ openness;
- Designations (Area of Outstanding Natural Beauty (AONB), National Park, etc.);
- Historical or cultural associations;
- Rarity;
- Wildness/ tranquillity; and
- Tolerance to change.

The sensitivity of a LCA reflects the contribution the attribute makes to the landscape and the degree to which the attributes can be replaced or substituted. This aspect of the assessment is derived from professional judgement and is also informed by the NILCA.

9.4.3 Visual Baseline Conditions

9.4.3.1 Visual Receptors

A Zone of Theoretical Visibility (ZTV) has been prepared to define the area within which the dualling scheme could potentially be visible. The ZTV was generated using KeyTerra Firma specialist computer software, and is based on the visibility of a high sided vehicle (4m above carriageway level) travelling on the road.

The DMRB Volume 11, Section 3, Part 5 Landscape Effects, states that:

'..*where it becomes impractical to determine the horizon from the desk study a cut-off line should be marked on the plan at a distance of 1000m from the line of*

58 DMRB Section 2, Part 5, HA 205/08 Assessment and Management of Environment Effects Highways Agency. August 2008

the road and more detailed fixing of the visual contour left to the site inspection. Adverse visual impacts in flat areas at more than 1000m from the road are unlikely to be significant but where such a limit forms part of the final VEM [Visual Envelope Map] an appropriate note should be added.'

On this basis, the visual study area has been defined by a 1 kilometre (km) offset either side of the centreline of the proposed scheme. Any notable receptors located beyond the 1km range identified during field survey have been assessed.

Views from visual receptors within the ZTV have been recorded in a consistent manner in accordance with the DMRB assessment criteria[59]. Each visual receptor has been recorded in the Visual Intrusion Schedule (VIS) (**Appendix D2, ES Volume II**) and identified on the Visual Intrusion Drawings (VIDs), **Drawings A8-S3-3118 to A8-S3-3122, Appendix D3, ES Volume II**. Views from visual receptors have been checked and refined during the winter months when vegetation cover provides a reduced level of visual screening.

9.4.3.2 Visual Sensitivity

In determining the sensitivity of visual receptors a high importance is placed on the permanence (versus transience) of the receptor within the study area. The identification of the baseline visual sensitivity, as shown in Table 2, **Appendix D1, ES Volume II**, is based on criteria derived from the GLVIA.

The sensitivity of visual receptors can be further influenced by a range of factors to include:

- The location of the viewpoint;
- The importance of the view (popularity, cultural associations);
- Public accessibility; and
- The occupation and expectations of the receptor (e.g. residents/ users of recreational facilities/ workers in their workplace/ motorists passing through).

9.4.4 Methodology for Assessment of Effects due to Construction and Operation

The methodology employed to assess the effects arising from construction, operation and the design year is applied consistently. Although the source and nature of the effects arising will differ, the effects have been assessed through the application of the same methodology.

9.4.4.1 DMRB Assessment Scenarios

In accordance with DMRB guidance[60], the absence or presence of the new dual carriageway is referred to as the Do Minimum and Do Something scenario respectively.

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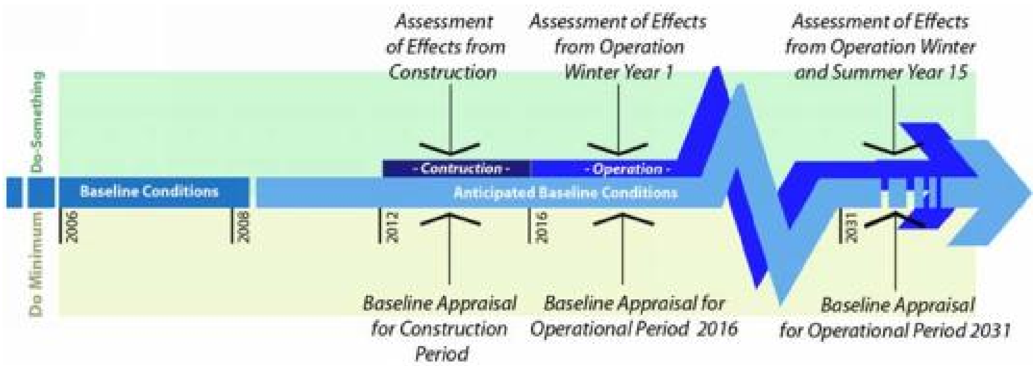
59 DMRB Volume 11: Section 2, Part 5 Landscape Effects, paragraph 4.10
60 DMRB Volume 11: Section 2, Part 5, HA 205/08 Assessment and Management of Environment Effects

The Do Minimum scenario addresses the likely changes to the landscape and visual resource that are anticipated in the absence of the new dual carriageway. The effects identified under the Do Minimum scenario constitute the baseline criteria for the Do Something scenario, i.e. the future development will form the basis for the assessment of the A8 Dualling Scheme.

For the Do Something scenario, the likely landscape and visual effects during the Construction Years (2012 - 2016), the Opening Year (2016) and the Design Year (2031) arising from the A8 Dualling scheme are assessed separately.

Figure 3 illustrates the assessment scenarios over the life of the A8 Dualling Scheme.

Figure 3 **Assessment Scenarios**



9.4.4.2 Do Minimum Scenario

In determining the potential change to the landscape and visual resource, reference has been made to the future development sites identified in chapter 16.5.2.3 'Community and Private Assets'. The future developments identified are those which can be reasonably foreseen, all of which are scheduled to begin construction prior to the completion of the A8 Dualling scheme. Consequently, the anticipated changes to the landscape and visual resource for the Do Minimum scenario are judged to be the same for the construction period, the opening year and the design year due to the absence of any further development in this period.

The baseline conditions have been considered in order to identify and understand what the key landscape and visual attributes are and how these might change over time due to future development or natural change. In this context, the following considerations have been examined:

- The LCAs and how these could change between 2009 and 2016, and by 2031;
- The sensitivity of the landscape to the change between 2009 and 2016 and by 2031; and
- Visual receptors present in the assessment area and how these could change over the same time period.

9.4.4.3 Do Something Scenario

Effects may be divided into landscape effects and visual effects and the two principal criteria which determine the significance of an effect are the sensitivity of the receptor and the magnitude of change. The type and nature of the proposed scheme is a determining factor on both the sensitivity and the magnitude of change.

9.4.4.4 Landscape Assessment

Landscape Sensitivity

The inherent and intrinsic sensitivity of the landscape addressed in the baseline is applied to determine the sensitivity of the landscape to the proposed change. The following criteria are assessed to determine the landscape's sensitivity to change:

- The proposed change – the degree to which the baseline elements or characteristics would be affected;
- The scope for mitigation – the ability to avoid, reduce, remedy or offset the effect;
- Replacement or substitution – the degree to which elements or characteristics can be reserved; and
- Existing trends of change – an account of the natural or human activities that may alter the landscape.

Landscape Magnitude of Change

The likely nature and magnitude of change to individual landscape receptors and characteristics as a result of a particular development are described in order to determine the consequential effect on landscape character.

Factors that have been considered in assessing the magnitude of change (either beneficial or adverse) comprise:

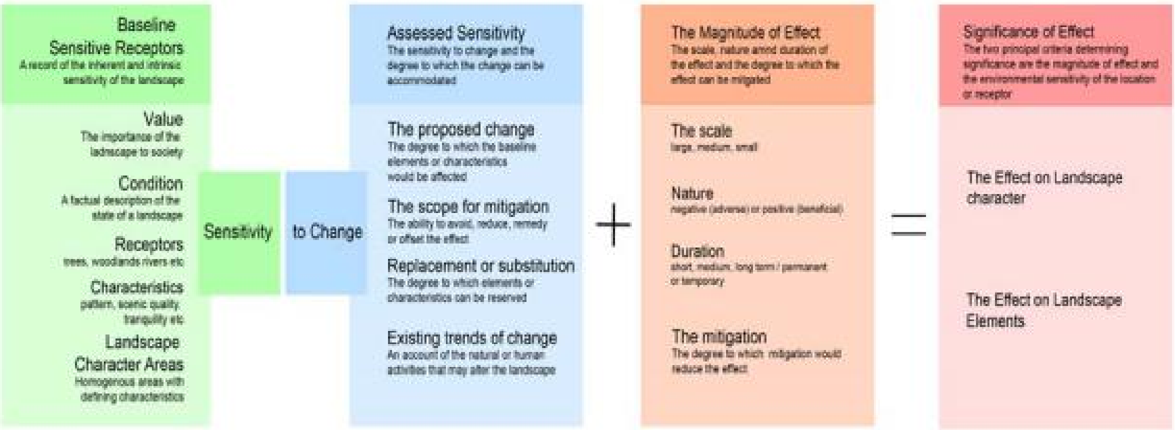
- The scale of the proposed change (large, medium, small);
- The extent to which the change (removal/addition) of landscape features alters the landscape character;
- The extent and nature of the area over which the effect is evident, either negative (adverse) or positive (beneficial);
- The duration of the effect (short/ medium/ long term, permanent/ temporary); and
- The effectiveness of the mitigation proposed.

In accordance with DMRB guidance the magnitude of change is defined using a nine point scale, as indicated in Table 3, **Appendix D, ES Volume II**.

9.4.4.5 Determination of the Significance of the Landscape Effect

Determination of the significance of an effect requires the application of professional judgement to assess the likely outcome. As illustrated in Figure 4, an assessment of the inherent sensitivity of the landscape and the sensitivity to the proposed change, together with the magnitude of the effect are combined to determine the overall landscape effect.

Figure 4 **Landscape Assessment Process**



Effects may be judged to be adverse or, where the effect results in an enhancement of the existing situation, beneficial. The broad criteria that influence the level of the effect, as outlined in the DMRB guidance, are included in Table 4, **Appendix D1, ES Volume II**.

9.4.4.6 Visual Assessment

Visual Sensitivity

Similarly to the landscape sensitivity, the inherent sensitivity of the visual receptors addressed in the baseline is applied to determine the sensitivity to the proposed change.

The following criteria are assessed to determine the visual sensitivity to change:

- The location and context of the viewpoint;
- The expectation and occupation or activity (e.g. residents/ users of recreational facilities/ workers in their workplace/ motorists passing through);
- The importance of the view;
- Extent of screening or filtering of the view (e.g. by buildings or vegetation); and
- Whether the view is transient or one of a sequence of views, as from a moving vehicle or footpath.

Visual Magnitude

The magnitude of change is described using the 5 point scale, as indicated in Table 5, **Appendix D1, ES Volume II**.

The magnitude of change has been considered for individual visual receptors with reference to the following indicators adapted from the GLVIA:

- The scale of change in the view with respect to the loss or addition of features in the view and changes in its composition including the proportion of the view occupied by the proposed development;

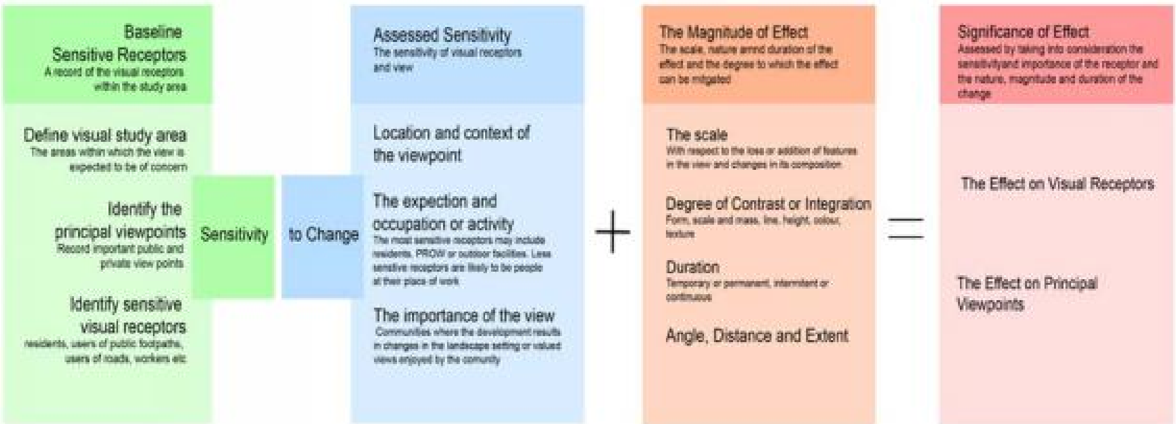
- The degree of the contrast or integration of any new features or changes in the landscape with the existing or remaining landscape elements and characteristics in terms or form, scale and mass, line height, colour and texture;
- The duration and nature of the effect, whether temporary or permanent, intermittent or continuous;
- The angle of view in relation to the main activity of the receptor;
- The distance of the viewpoint from the proposed development; and
- The extent of the area over which the changes would be visible.

Using these indicators professional judgement is applied to determine the degree of alteration to the existing view for each receptor, as a result of the dualling.

9.4.5 Determination of the Significance of the Visual Effect

Determination of the significance of an effect requires the application of professional judgement to assess the likely outcome. As with landscape effects, the synthesis of the visual sensitivity to the proposed change and the magnitude of effect are applied to determine the nature of the effect on the visual resource, as illustrated in Figure 5 below.

Figure 5 **Visual Assessment Process**



In Table 6, **Appendix D1, ES Volume II**, the significance criteria are set out in the seven-point assessment scale in accordance with DMRB guidance.

9.5 Limitations and Assumptions

9.5.1 Limitations

The assessment of landscape and visual effects has been undertaken through a combination of desk study and site survey work. In general, assessments have been made from publicly accessible viewpoints, recording the inter-visibility between the receptor and the proposed road corridor

9.5.2 Assumptions

The VIS records the effects on the visual receptors that would arise as a result of the scheme during operation (2016) and in the design year (2031).

This assessment takes account of the trees and shrubs planted as an integral component of the proposed scheme. It is assumed that during the operational period the planting would have a limited contribution to reducing the adverse effects. For the purposes of the assessment it has also been assumed that any tree planting by the design year would have achieved a height of 4.5m. This assumption is based on predicted growth rates of 0.3m per annum which, given the application of appropriate planting and management techniques, is considered to be a conservative estimated height. This predicted growth rate is based on experience from comparable highway schemes. The screening effect of vegetation would be less effective in winter in comparison to the summer months.

9.6 Baseline Conditions

9.6.1 Designations

The landscape study area includes a number of statutory protected designations which are outlined in the following sections.

9.6.1.1 Area of Outstanding Natural Beauty (AONB)

The Antrim Coast and Glens AONB occupies the valley slopes to the north of the A8 corridor, extending from Ballycastle to Larne.

The area is dominated by a high undulating plateau cut by deep glens which open north and eastwards to the sea. It is occupied by areas of contrast with gentle bays separated by blunt headlands, exposed moorlands that give way to sheltered valleys and wide open expanses to enclosed farmland.

9.6.1.2 Local Landscape Policy Area (LLPA)

The Belfast Metropolitan Area Plan (BMAP) has designated two LLPAs in Ballynure. The Plan states that the LLPAs are considered to be of the greatest amenity value, landscape quality or local significance and that must be protected from undesirable or damaging development.

Main Street LLPA (BNE[61] 04) includes the Ballynure Methodist Church and manse which is considered to contribute to the environmental quality and character of the area and is considered to be locally important.

Ballynure River LLPA (BNE 05) includes the following areas:

- Area of local nature conservation interest – Ballynure River corridor which is an important local nature area. The western part of the LLPA consists of a planned landscape with significant parkland trees;
- Christ Church listed building and its surroundings;

[61] BNE is an abbreviation used within BMAP to refer to policies relating to the settlement of Ballynure.

- Locally significant buildings and their surroundings – The rectory, old mill and school, together with associated vegetation; and
- Archaeological site and its surroundings – The modern church is located near the remains of a medieval church and graveyard with significant vegetation including yew trees.

9.6.1.3 Tree Preservation Order (TPO)

A TPO group exists on land east of the A8 at Lisglass Road. A tree survey has been prepared on behalf of the Planning Service Department by Mr Andrew Boe of M Large Tree Services Ltd (6th June 2006 refer to **Appendix D4, ES Volume II**). This report states that the trees are all Beech, Sycamore or Ash and the majority are in fair condition and of a mature age.

The Tree Survey Report recommends that four trees be felled to maintain site safety. Where feasible and if site safety will not be compromised, the report states that poor trees should be allowed to stand as they can provide a valuable resource for the local ecosystem.

Figure 6 **Photo of TPOs to the north of Lisglass Road**

9.6.1.4 Scheduled Historic Monument (SHM)

The Lowtown Rath is designated as a SHM and is situated immediately adjacent to the west of the A8. A rath is a circular hill fort protected by earthworks, used by the Irish in the pre-Christian era as a retreat in times of danger. A baseline description and an assessment of the effects are included in chapter 10 'Cultural Heritage'.

Figure 7 **Lowtown Rath SHM**

9.6.1.5 Clements Wood

Clements wood is a Woodland Trust site situated to the east of the FP McCann, Loughside Quarry. The area is bound by the A8 to the north and is accessible from Ballygowan Road to the east. The wood consists of approximately 0.5ha of hazel copses, 2.5ha of planting including open space, and 1ha of wet meadows, situated between the Larne River and the disused Larne railway line. The wood was called Clements after the vendor farmers grandfather, who first bought the land in the late 1800s. It was farmed traditionally through the family line, with no use of fertilisers, mainly used for grazing and hay. The fields were grazed until mid 2000 and are now regenerated with native species

Figure 8 **Photo looking north across Clements Wood towards hills in the distance**

9.6.2 Landscape Receptors

Landscape receptors are components of the landscape that contribute to the landscape character. The landscape receptors associated with the A8 Dualling are recorded on **Drawings A8-S3-3100 to A8-S3-3107, Appendix D3, ES Volume II** and include:

Topography

The gently undulating topography is characteristic of the A8 scheme assessment area with long south west to north east ridges evident to the east.

Woodlands

Areas of woodland vary in scale and are apparent across the landscape, occupying the hill tops and lower slopes.

Hedgerows

The agricultural landscape is defined by a strong network of hedgerows that define the large geometric field pattern. Hedgerow trees are also a common feature.

Watercourses

Watercourses traverse the landscape along the A8 corridor including the 'Six Mile Water', 'Ballynure Water' and a number of smaller streams further east. The Six Mile Water is situated to the west of the existing A8 and branches east near Ballynure to join Ballynure Water which passes in a east-west direction through the centre of Ballynure.

Land use and Field Pattern

The landscape is characterised by arable and pastoral farmland and geometric fields which are defined, in part, by a strong network of hedgerows and field boundary walls.

Transport Corridors

The A8 single carriageway and stretches of existing dualled carriageway, supports a network of local roads that respond to the field pattern and landform.

Settlements

The residential area of Ballynure is the largest settlement along the A8 corridor with a population of approximately 700. The village is effectively divided by the A8 which passes in a north-south direction. Ballynure has a rich industrial heritage and the industrial past is still evident in the landscape with the ruins of an old cotton mill to the south west of Ballynure.

To the south, the small linear settlement of Bruslee is situated alongside the A8 corridor with a number of properties along adjoining local roads, including Logwood Road, Glen Road and Lisglass Road.

Across the assessment area, dispersed residential development along the local road network is common place with scattered farmsteads evenly distributed throughout the landscape.

9.6.3 Landscape Character Areas (LCAs)

The NILCA 2000 divides the Province into a series of discrete geographical units or LCA's. These LCA's have been determined through a synthesis of various elements to include landform and geology, vegetation and habitat, cultural heritage, land use, water features and scenic qualities.

The LCAs in the vicinity of the existing A8 corridor are described below with the boundaries defined on **Drawing A8-S3-3109**. Viewpoint locations and supporting photographs are included in **Drawing A8-S3-3110 to A8-S3-3116, Appendix D, ES Volume II**.

9.6.3.1 Tardee and Six Mile Water Slopes Landscape

This LCA encompasses the southern end of the existing A8.

The topography of this LCA is predominantly undulating land on low lying slopes, opening out to flatter pastoral land to the south east. The uneven and varying topography results in an irregular field pattern.

There are no major settlements within the area, but many small settlement clusters, farms and smallholdings are scattered across the lower valley slopes. The network of lanes and minor roads connecting the properties criss-cross the landscape and permit some long views into the valley of the Six Mile Water.

The existing A8 corridor is generally sympathetic to the natural landform and is well integrated into the landscape through the undulating topography and field boundary hedgerows. The group of trees covered by TPOs situated in close proximity to the A8 at Lisglass Road, are located within the LCA.

Refer to chapter 9.6.1.3 for a description of the TPOs.

Landscape Baseline Sensitivity

Some areas of the landscape appear rather degraded due to the neglect of field boundaries and pasture. Further detractors include the presence of a large number of electricity pylons bordering the LCA to the north and south which intrude into the rural setting. The steeper slopes, on the fringes of the upland areas, are however particularly sensitive to change with distant views across the surrounding uplands.

The landscape sensitivity to change is judged to be ***low to medium*.**

9.6.3.2 Three and Six Mile Water Valley Landscape

This LCA occupies the centre of the scheme assessment area and encompasses the settlements of Ballynure and Ballyclare.

The LCA boundary follows the valley floor with the Six Mile Water meandering to the north of the A57 Templepatrick Road. The village of Ballynure occupies the north east boundary of this LCA together with associated road infrastructure, including the A8, A57, B58 and a network of local roads. Other urbanising features include the lighting associated with the road network and the series of electricity pylons that pass through the locality of Ballynure in an east-west direction.

Ballynure has a rich industrial heritage that includes early nineteenth century corn mills and cotton mills. This industrial past is still evident in the landscape today with the ruins of an old cotton mill and associated landscape features that can be seen from Church Road (see **Drawing A8-S3-3103, Appendix D3, ES Volume II**). This site has consequently been designated as a LLPA and is considered to be of great amenity value. Other areas included within this local designation are Ballynure Main Street and the Castle Water River that flows through the village.

Landscape Baseline Sensitivity

The settings for the built development are often incoherent and lead to a rather degraded visual character in some areas. The extent of new built development in certain areas has a substantial impact and continued hedgerow loss would result in a greater sensitivity to landscape change.

There are long views along the valleys from the narrow roads linking settlements, especially on the lower slopes and both river valleys offer elevated views from the surrounding ridges and hills. These features are therefore relatively sensitive to change.

With particular regard to the locally important landscape designations, the sensitivity to change of this LCA is judged to be ***low to medium*.**

9.6.3.3 Larne Ridgeland Landscape

The area north of the existing A8 corridor consists of land within the Larne Ridgeland LCA.

The topography of this LCA is characterised by an undulating landform with a distinct valley profile dominated by long south west to north east ridges. The low lying topography towards the valley floor is largely occupied by a geometric regular field pattern, commonly bound by robust hedges and small thickets of woodland that add to the diversity of the land cover. This pattern forms a transition to more marginal upland agricultural areas where there are smaller fields, a greater preponderance of stone and earth walls, greater encroachment from scrub growth, rushes to poorer drained fields and a more exposed landscape character.

The pattern of fields on the valley slopes in the northern corner of this LCA lie within the Antrim Coast and Glens AONB. This designation is indicative of the nationally important scenic value of the landscape in this area. In addition, bordering (and occasionally overlapping) the AONB just to the east lays one of two green belt designations within the scheme assessment area. Further landscape designations within this LCA include Clements Wood, situated immediately adjacent to the A8 (see **Drawing A8-S3-3106, Appendix D3, ES Volume II**).

The vertical alignment of the existing A8 corridor mostly follows, and is generally sympathetic to the natural landform, but shallow cuttings and low embankments are present. The network of local roads and accesses to private properties connect to the A8 and contribute to the level of tranquillity and access to the wider landscape. Other landscape features within this LCA include industrial activity associated with the Loughside Quarry located on the undulating slopes immediately to the south east of the A8.

Landscape Baseline Sensitivity

The field structure is robust although certain areas are prone to decline through lack of management. Roads and pylons are visually intrusive, although the alignments generally follow the natural contours. The pattern of fields and occasional stands of woodland on the valley slopes and the ridge tops are particularly sensitive to change.

With due regard to the national importance of the AONB within this LCA and the locally important Clements Wood, the sensitivity to change is assessed as ***high***.

9.6.3.4 Carrickfergus Upland Pastures

The LCA of Carrickfergus Upland Pastures lies to the east of the existing and proposed A8 dualling.

The topography of this LCA is characterised by an undulating landscape of low ridges and shallow valleys. The land use is predominantly pastoral with small, regular fields enclosed by gappy hedges, as well as by earth banks and stone walls. In some areas, these are neglected and field boundaries have been replaced with post and wire fencing.

The uplands appear relatively remote in comparison to nearby, low-lying areas, although overhead power lines from the Kilroot Power Station cross this LCA. These routes exert a strong presence in the immediate landscape and the pylons and catenaries can be traced for some distance by virtue of the expansive landscape. The telecommunications mast on Carn Hill features in middle and long distance views. Settlement is scarce, but new houses, often in exposed locations, contrast with the traditional pattern of sheltered locations chosen to locate the traditional stone farm buildings which have an unassuming style.

The existing A8 lies to the north of this LCA, with views largely restricted by intervening vegetation and the undulating landform from glacial deposits.

Landscape Baseline Sensitivity

This relatively remote landscape has not been subjected to the same level of residential development experienced by the low-lying areas close to the coast. Plantation forests have been introduced along the ridge tops, but generally these follow the natural landform. This type of upland pastoral landscape is not rare in Northern Ireland.

The NILCA describes the sensitivity of this LCA as ***medium***. Although this is an upland area, views are largely restricted by virtue of the localised undulating landform and the sense of enclosure afforded by tree cover.

9.6.3.5 Larne Basalt Moorland

This LCA lies to the north east of the existing and proposed A8 corridor and crosses the Ballymena and Larne district boundary.

The hills within this LCA form a backcloth for the lowlands and surrounding valleys and provide a landmark that dominates the skyline. It includes the upland summits of Slemish, Douglas and Agnew's Hill that lie to the north of the scheme assessment area, as well as Black Hill and Robin Young's Hill that overlook the rocky coastline to the north east of Larne. The landscape around Slemish is well maintained and falls within the Antrim Coast and Glens AONB. This area is also designated as an Area of Special Scientific Interest (ASSI) and an Earth Science Conservation Review (ESCR) Site.

Sheep grazing dominates as the major land use with small scale peat cutting and forestry on the higher ground. Narrow roads cross the moorland and wind around the edges of the summits, affording clear views into the surrounding low-lying farmland.

The existing A8 does not pass through this LCA. Views towards the alignment are largely screened by intervening vegetation and the undulating landform into which the existing road has been accommodated.

Landscape Baseline Sensitivity

The open character and high visibility of the moorland summits renders them highly sensitive to changes in land use pattern, land cover or vegetation structure. Scenic quality, AONB status and the popularity of the landscape with visitors also contribute to its sensitivity. Consequently, the sensitivity of this LCA is judged to be ***high***.

9.6.4 Visual Baseline Conditions

The visual baseline conditions are supplemented by the following drawings from **Appendix D3, ES Volume II**:

- Drawing A8-S3-3108 - Topography;

- Drawing A8-S3-3110 - Viewpoint Location Plan;
- Drawings A8-S3-3111 to 3116 - Photographs;
- Drawing A8-S3-3117 - ZTV;
- Drawings A8-S3-3118 to 3122 - VID; and
- VIS – Appendix D2, ES Volume II.

9.6.5 Visual Baseline Study Area

The ZTV for the A8 Dualling has been used to establish the theoretical area from which the A8 would be visible. Site surveys have verified the location of the visual receptors and each receptor is recorded on the VID's. Where appropriate, the VID receptor reference number has been provided in brackets below, to cross reference the visual receptor description to the location provided on the VID's.

A description of the view from each receptor is recorded in the VIS. The visual receptors are categorised as residential, commercial and recreational receptors.

9.6.5.1 Residential

The scheme assessment area to the south comprises a sporadic arrangement of farms and small holdings on low lying ground. Views towards the A8 from these residential receptors are largely filtered by intervening hedgerows along the field boundaries. Glimpse views are more apparent where the road passes on embankment and where the field hedgerows provide only a limited screen.

A number of properties within the settlement of Bruslee are situated immediately adjacent to the A8 with clear views of passing traffic and lighting along the A8 corridor. With increasing distance from the road corridor, views become more obscured by intervening vegetation and changes in topography.

Across the scheme assessment area the hedgerows associated with the field pattern and the network of local roads provide an effective level of screening during the summer months, reducing in the winter months to allow filtered views of passing vehicles. Areas of mature woodland provide an effective screen for a number of residential properties.

Further north the residential area of Ballynure is divided by the A8 which passes in a north-south direction. The housing layout of this area is mostly inward facing and insular in nature with front aspect views predominantly across local roads towards adjacent residential properties. Similarly to Bruslee, residential properties that are situated in close proximity to the A8 experience clear views of passing traffic and lighting columns along the A8.

To the north of the scheme assessment area, the topographical variation influences the extent of the view from residential receptors and the inter-visibility of the A8. Where views towards the A8 are possible they are frequently filtered by vegetation.

The typical landscape treatment along the A8 consists of hedgerow planting that defines the adjacent agricultural fields and assists with screening views towards the A8 from residential properties in the immediate vicinity.

9.6.5.2 Commercial

To the south a number of commercial receptors are present in the settlement of Bruslee, including Boyd Landscapes Ltd, East Antrim Metals and Recycling Centre (41) and CK2 Centre (66). The commercial premises directly adjacent to the A8 have a clear view of passing traffic and lighting with intermittent area of planting providing a degree of screening in specific views.

Further north, Fleck Bros Coachworks Ltd is situated off the Templepatrick Road to the west of the A8 and Rock Bank farmhouse bed and breakfast is situated to the east. Fleck Bros Coachworks has views across agricultural fields with mature planting along the east boundary. Rock Bank farmhouse bed and breakfast, north of Fleck Bros Coachworks, is situated in a slightly elevated position with a view across falling ground to the existing A8 and surrounding agricultural land.

Within Ballynure a number of commercial properties exist along Main St. including Jackson's Butchers (217), the Post Office and the Co-op (220), and the Ballard Inn (223). The view from these receptors is restricted to adjacent residential properties and the Presbyterian Church. Within Ballynure a petrol filling station and 'Beatties' fish and chip shop are situated directly adjacent to the A8 with clear views of passing traffic across car parks.

At the northern end of the assessment area, a Road Service Depot, McCartney Motors and Kilwaughter Filing Station are situated in close proximity to the A8 with clear front elevation views towards traffic on the A8.

9.6.5.3 Public

A number of the designations described in chapter 9.6.1 are considered as public visual receptors. These include the following:

- Antrim Coast and Glens AONB;
- The Ulster Way;
- Local Landscape Policy Areas (BNE 04 and BNE 05); and
- Clements Wood.

The visual description of theses landscape designations is contained within chapter 9.6.1. In addition to the above, a number of churches, halls, schools and footpaths are present along the existing A8 corridor. A baseline description of these public receptors is included below.

To the south of the assessed area, Bruslee Sunday School (61) is located immediately adjacent to the A8 with a clear front aspect view beyond the existing boundary wall to passing traffic along the A8.

Further north within Ballynure, Ballynure Methodist Church (208) and Ballynure Presbyterian Church (225) are situated on Main Street, to the east of the A8, and Church of Ireland Christ Church (252) and Parish Hall (249) are situated on Church Road, west of the A8. Ballynure Methodist church is set back from the A8 with a clear view of traffic with a distant view towards the hills. The view from Ballynure Presbyterian Church is limited to commercial properties along Main Street with a rear view across the church car park towards the A8. The Church of Ireland Christ Church is situated within larger grounds with a front aspect view across Church Road to the graveyard with residential properties situated to the rear. The associated church hall is a single storey property located on Church Road experiencing a similar view towards the adjacent graveyard across Church Road with parking to the sides and rear. Ballynure Primary School (254) is situated on Lismenary Road, with a front view filtered by evergreen vegetation towards the Ballynure Memorial Park.

Moving north along the A8, Holy Family Church (481) is situated on Ballygowan Road with a view across the grounds beyond the road side hedge to agricultural land. As Ballygowan Road approaches the A8 further north, Old School (494) is situated to the west of Ballygowan Road, experiencing a front aspect view across road side vegetation to agricultural land and a rear view to an evergreen boundary hedge.

Further north beyond the immediate A8 corridor, Kilwaughter Village Hall (563) is situated in an elevated position experiencing a wide, distant view across the landscape with rising hills in the distance.

9.7 Environmental Design

As detailed within chapter 5.3.1, the A8 Dualling scheme has progressed with continuous collaboration between the design team including environmental specialists. Through this process, an environmental design has been developed as an integral part of the overall scheme design. These measures have been assessed as part of the scheme and are not considered to be additional mitigation measures.

For the purposes of this assessment the landscape and visual environmental design measures that have been incorporated into the A8 Dualling scheme are described below.

Embankment and Cutting Slope Profile

Profile changes between the new and the artificial gradients and the existing natural topography requires careful consideration to detail. The crest and the toe of embankments and cutting slopes have been sympathetically profiled to create a gradual transition and reflect the drumlin landscape. **Drawings A8-S3-3136 and A8-S3-3137, Appendix D, ES Volume II**, illustrate typical embankment and cutting slope cross sections.

Tree and Shrub Planting

Residential properties are considered to have a high visual sensitivity. As part of the scheme design, a landscape treatment has been developed to provide screening at various locations to reduce the adverse visual effects on these receptors. The planting would consist of native species with a percentage of evergreen trees and shrubs to assist with filtering views towards the dualled A8 during the winter months. Refer to **Drawing A8-S3-3138, Appendix D, ES Volume II**, for a typical tree and shrub planting cross section and **Drawing A8-S3-3144, Appendix D, ES Volume II**, for an indicative planting list.

Extend Woodland Edge

Areas of woodland vary in scale and are apparent across the landscape, occupying the hill tops and lower slopes. Where appropriate, woodland planting has been proposed to integrate the alignment and reflect the existing landscape character. These areas would consist of a native woodland mix. Refer to drawing A8-S3-

3139 for a typical cross section and **Drawing A8-S3-144, Appendix D, ES Volume II**, for an indicative planting list.

Replacement Hedgerows and Walls

Existing vegetation in close proximity to the new carriageway would be protected and retained where possible. Hedgerows and dry stone walls parallel to the existing A8 which are lost during construction would be reinstated as appropriate.

Hedgerows lost during construction and proposed hedgerows that will form part of the landscape treatment will be designed and planted in accordance with the DARD Countryside Management Scheme (2007-2013) information booklet. Refer to **Drawings A8-S3-3140 and A8-S3-3141, Appendix D, ES Volume II**, for typical cross sections.

Planting Areas – Growing Medium

A suitable growing medium for proposed planting areas has been agreed and forms part of the engineering design and the land take requirements, ensuring the establishment of the proposed planting. Refer to **Drawing A8-S3-3144, Appendix D, ES Volume II**, for a series of typical cross sections.

Attenuation Ponds

Proposed attenuation ponds will be sympathetically designed to integrate the pond into the landscape and reflect the contours of the adjoining topography. A detailed landscape design will be developed to integrate the ponds where necessary during the detailed design stage. It is anticipated that the boundary treatment will consist of a post and rail fence or hedgerow to reflect the existing landscape character. Refer to **Drawing A8-S3-3146, Appendix D, ES Volume II**, for a typical cross section.

Rock Cutting Treatment

Exposed rock cutting will be appropriately designed to add visual interest, provide a sense of place and act as a landmark. Refer to **Drawing A8-S3-3147, Appendix D, ES Volume II**, for two typical cross sections.

Junction Arrangement

Dense planting is proposed to develop a strong landscape statement, screen views and integrate the junction arrangement into the surrounding landscape. Refer to **Drawing A8-S3-3148, Appendix D, ES Volume II**, for two typical cross sections.

Through collaboration with the ecology team, an indicative species list has been prepared to reflect the landscape character and enhance local biodiversity. Refer to **Drawing A8-S3-3144, Appendix D, ES Volume II**, for an indicative planting species schedule.

9.8 Assessment of Effects due to Construction

The following assessment describes the landscape and visual effects arising from the construction of the A8 Dualling. The construction effects have been summarised to capture the principal components of the construction activity between 2012 and 2016.

It is assumed that the A8 would remain in operation throughout the construction phase.

The principal components of the construction activity that would affect the LCA's and visual receptors are likely to include the following:

- Vegetation removal;
- Site access and haulage routes using the existing road infrastructure;
- Fixed construction plant;
- Mobile construction plant such as excavators and lorries;
- Excavation at junctions and areas of cut and fill operations;
- Stockpile and material storage areas;
- Contractor's site compounds;
- Security and safety lighting;
- Localised changes to topography;
- Construction of landownership access routes; and
- Lighting in areas of previously unlit landscape.

9.8.1 Do Minimum Scenario – Landscape Assessment

The Do Minimum scenario assesses the likely changes to the landscape resource during 2012 and 2016 in the absence of the A8 Dualling scheme.

The Landscape may undergo localised changes prior to, or during this period. These changes include future development sites identified within local area plans as detailed in chapter 16.5.2.4 and sites currently with planning consent, as listed within **Appendix K, ES Volume II**.

9.8.1.1 Landscape Assessment

The trees and hedgerows associated with the LCA's would continue to grow and replace themselves through natural regeneration or be replanted through an extension of current farming practice. It has been assumed that areas of existing woodland would be slow growing and that the hedgerows would continue to be managed in the way that they are currently.

It has also been assumed that the LCA boundaries will remain the same and that in the Do Minimum Scenario there would be negligible change to the sensitivity and value of the LCA's.

The future development sites identified together with the incremental changes to the landscape resource are judged to result in a ***neutral*** effect on the LCA's.

9.8.2 Do Something Scenario – Landscape Assessment

The natural and incremental changes in the landscape considered under chapter 9.4.4.2 Do Minimum Scenario, contribute to the landscape baseline conditions and have been taken into account for the Do Something scenario.

9.8.2.1 Landscape Effects

The individual landscape receptors identified in the baseline contribute to the definition of the LCA's. The effect on landscape receptors is described with reference to the LCA's within the assessment area.

Refer to **Drawing A8-S3-3109, Appendix D, ES Volume II**, for the location and extent of the Landscape Character Areas within the A8 scheme assessment area.

9.8.2.2 Tardee and Six Mile Water Slopes

The off-line section would commence at Coleman's Corner with the construction of an embankment to the east of Bruslee. Further north, excavation work would commence at Lisglass Road before rejoining the existing A8. The deposition and excavation of material associated with this off-line section would result in the clearance of existing vegetation and localised variations in topography. The clearance of vegetation would expose views towards the construction areas and the presence of construction plant in this area. A proposed attenuation pond would be located in this area. Private access arrangements would be diverted at various stages of the project together with the realignment work associated with Lisglass Road. The removal of hedgerows to accommodate these diversions would further expose the construction work within this rural LCA.

Further north the alignment would join the existing A8 and broadly consist of asymmetrical online widening, resulting in the removal of further road side vegetation. Temporary and permanent attenuation ponds would be constructed in this area and a number of existing private means of access within this area would be diverted during the construction work.

The construction work associated with the Calhame Road compact grade separated junction would commence with the deposition of structural material with the addition of soil to provide a shallower slope profile. The construction of the junction would introduce a vertical structure in the landscape with the addition of a slip road to the west and a roundabout to the east with associated radial slip roads.

Further north the construction of the new carriageway would remain online on approach to the proposed A57 Templepatrick Road junction. The junction falls within the Three and Six Mile Water Slopes LCA. The construction effect associated with this LCA has been assessed in chapter 9.8.2.3.

Beyond the Templepatrick Road junction the proposed scheme moves off-line from the existing A8 to the west of Ballynure. Moving north the alignment would move from cutting to embankment within the Tardee and Six Mile Water Slopes. The embankment would lead to the construction of the Church Road culvert, approximately 8-9m above the existing Church Road. The construction work associated with the embankment and the culvert would commence with the clearance of existing vegetation, opening views towards the construction plant and the works throughout the construction period. The construction of the culvert and the associated approaching embankment would be at variance with the surrounding topography and cut across the natural grain of the landscape. Church Road would be permanently severed by the construction of the dualled A8 and stopped up either side of the alignment. A new link road would be constructed to the west of the dualled A8, connecting Church Road to the proposed

Templepatrick Road junction. The deposition and excavation of material associated with the new link road would result in further vegetation clearance and increase the overall width of the proposed construction work and road corridor in this area.

Permanent and temporary attenuation ponds and construction areas would be located adjacent to embankment requiring further vegetation removal. Further north beyond the Church Road culvert construction work would consist of further excavation to a depth of up to approximately 6-7m below the proposed Lismenary Road overbridge, before returning to an at-grade position south of Ballybracken Road compact grade separated junction. Similarly to the southern section of cutting, the construction work would result in the removal or vegetation and cut across the natural grain of the landscape.

The Ballybracken Road compact grade separated junction would be situated in cutting. Construction work would commence with the clearance of existing vegetation and excavation to accommodate the new carriageway and the associated slip roads. At this point the scheme would realign with the existing A8 and further asymmetric online widening would continue north. Further north the alignment falls within the Larne Ridgeland LCA. The construction effects associated with this LCA have been assessed in chapter 9.8.2.4.

Construction Effect

The magnitude of change to this LCA during construction is judged to be moderate adverse. This, in conjunction with the low to medium sensitivity would result in a ***moderate adverse*** effect during construction

9.8.2.3 Three and Six Mile Water Valleys

The construction of the new carriageway would move off-line within this LCA and include the removal of existing vegetation and excavation work to a depth of approximately 10m below the realignment works associated with A57. The excavation work would be through an area of high ground and emerge through a ridgeline that broadly follows the A57. North of the A57, the ground falls away sharply and the cutting would have a direct effect on the relatively fine grain, traditional field pattern, mature hedgerows and riparian trees.

To the west of the A57 Templepatrick Road junction, one additional roundabout would be constructed with radial slip roads to provide access to and from the new carriageway. A new link road would ascend from this roundabout and be constructed on a large embankment, measuring approximately 14m at its highest point. The link road would extend from the ridgeline and descend south towards Church Road, parallel to the construction of the Ballynure bypass. At the widest point, the construction work to the north of the existing ridgeline would extend approximately 240m in width, reducing to approximately 70m further north.

Further north the construction work would include the deposition of material to facilitate the construction of Church Road culvert across the Ballynure Water.

The excavation and deposition of material associated with the proposed attenuation pond in this area would also result in an increase of construction activity.

Construction Effect

The construction of this junction arrangement would consist of substantial earthworks that would appear incongruous with the existing topography. The appearance would vary from graded slopes to areas of exposed rock in certain locations.

The magnitude of change to this LCA during construction is judged to be moderate adverse. This, in conjunction with the low to medium sensitivity would result in overall ***moderate adverse*** effect during construction..

9.8.2.4 Larne Ridgeland

From the south of Larne Ridgeland, construction work would consist of online asymmetrical widening and commence with the clearance of existing vegetation that currently lines the A8 corridor. Localised areas of earthworks would be required to widen the A8 within the existing corridor and construct temporary and permanent attenuation ponds.

Further north, the construction of Moss Road grade separated junction would begin with the deposition of structural material. Similarly to previous junction arrangements, the junction would introduce a vertical component in to the landscape. The construction of this component together with the associated slip road arrangements would appear incongruous with the existing topography and rural landscape character.

Beyond Moss Road junction the construction of the new carriageway would continue online. The alignment at this location would result in the loss of land to Clements Wood and the removal of existing vegetation. At this point, the construction work would move off-line slightly to the east of the existing A8 and realign with the existing A8 corridor at Deerpark Road grade separated junction. The deposition of material and the construction work for the junction and off-line section would result in the removal of existing hedgerows and roadside vegetation, opening views towards the construction work and the presence of construction plant in this area.

Continuing north, the construction work would consist of further online widening, resulting in the clearance of vegetation and further earthwork modelling. One of the existing embankments with a high degree of sensitivity is the drumlin with Lowtown Rath, a SHM on its summit. The construction work at this location would consist of further excavation, resulting in the edge of the new carriageway moving approximately 11m closer to the SHM in comparison with the existing A8.

At the Ballyrickard / Shane's Hill Road (A36) junction the staggered junction would to be replaced by a roundabout with associated new approach roads cutting across the immediate landscape from the west and east. This arrangement would cut across the existing field pattern and result in the loss of hedgerow cover.

Construction Effect

The dualling of the A8 within this LCA would consist of asymmetrical widening along the existing A8, with the exception of the off-line section south of the proposed Deerpark Road grade separated junction. Due to the presence of the existing A8, this landscape has a certain capacity to absorb the construction work within the existing corridor, although the removal of road side vegetation would expose the existing road traffic and construction work within the wider landscape. The construction of the junction arrangements would be incongruous with the existing land use and discord with the existing field pattern and rural character.

The magnitude of change to this LCA during construction is judged to be minor adverse. The baseline level of sensitivity is judged to be high due to the inherent sensitivity of the AONB. With due regard to the degree to which the change can be accommodated within this LCA, the assessed level of sensitivity is judged to be medium. The minor magnitude of change in conjunction with the medium sensitivity would result in a ***slight adverse*** effect during construction.

9.8.2.5 Carrickfergus Upland Pastures

Views towards the construction activity associated with the A8 Dualling are limited by intervening vegetation, properties and undulating landform. Limited areas with localised views towards the A8 are predominantly backclothed by rising ground towards the Larne Basalt Moorland LCA and AONB. In this context, the existing A8 is a small component of the view and consequently the A8 has a limited influence on this LCA.

Construction Effect

With due regard to the proximity of the construction activity together with the limited views towards the existing A8, it is judged that the magnitude of change would result in 'no change' to this LCA. In the absence of any change, this LCA would experience a ***neutral*** effect during construction.

9.8.2.6 Larne Basalt Moorland

Similar to the Carrickfergus Upland Pastures LCA, the views towards the construction activity associated with the A8 Dualling are limited by intervening vegetation, properties and undulating landform. Limited areas with localised views towards the A8 are predominantly backclothed by rising ground towards the Carrickfergus Uplands Pastures LCA. In this context, the existing A8 is a small component of the view and consequently the A8 has a limited influence on this LCA.

Construction Effect

With due regard to the proximity of the construction activity together with the limited views towards the existing A8 corridor, it is judged that the magnitude of change would result in 'no change' to this LCA. In the absence of any change, this LCA would experience a ***neutral*** effect during construction.

9.8.3 Do Minimum Scenario – Visual Assessment

It is anticipated that the existing number of visual receptors would remain largely unchanged with the exception of the future development sites, as recorded in chapter 16.5.2.4 and **Appendix K, ES Volume II**. The sensitivity of the visual receptors associated with the future development would be consistent with the baseline, however, the magnitude of change and the significance of the effect on future development cannot be determined as the following information is unknown:

- The exact location and orientation of the visual receptor;
- The nature of the view, e.g. wide panorama, framed or glimpsed view; and
- Extent of the screening or filtering of the view by a landscape treatment associated with the future development proposal.

The topography and existing vegetation would remain largely unchanged. Consequently, the Do Minimum Scenario for the construction phase would be consistent with the baseline visual conditions and the baseline descriptions included in the VIS (**Appendix D2, ES Volume II**).

As described in the landscape Do Minimum Scenario, the existing vegetation that currently contributes to the visual amenity would continue to grow and replace itself through natural regeneration or be replanted through an extension of current farming practices. It is assumed that areas of woodland would be slow growing and that the hedgerows would continue to be managed in the way that they are currently. Consequently, it is assumed that the vegetation would continue to provide areas of screening to visual receptors within the assessment area.

9.8.3.1 Visual Assessment

The natural and incremental changes to the visual amenity would result in a ***neutral*** effect.

9.8.4 Do Something Scenario – Visual Effects

The principal components of the construction activity that would be likely to result in adverse effects on visual receptors have been summarised in chapter 5 'The Proposed Scheme'.

Field surveys were conducted to record the following to assist with the assessment of construction effects on visual receptors:

- The receptor location;
- A general description of the receptor to include the building type, structure, roof material and aspect; and
- The characteristic of the existing view.

The visual receptors are recorded in the VIS (**Appendix D2, ES Volume II**). The location of each receptor is shown on VIDs **A8-S3-3118 to 3122**, **Appendix D3, ES Volume II**).

A summary of the visual receptors and likely effects during the construction phase is provided below. Where appropriate the VID and VIS receptor reference number has been provided.

9.8.4.1 B95 Coleman's Corner Roundabout to South of A57 Templepatrick Road Grade Separated Junction

The Coleman's Corner roundabout is an existing feature in the landscape. With the exception of properties 22, 24 and 25, the properties in close proximity to the roundabout are not judged to experience an increased visual effect during the construction phase. Property 25 is considered to experience a view from an elevated position towards the construction compound located at Coleman's Corner roundabout and the diverging A8 excavation work from the junction, resulting in a ***moderate adverse*** effect. Properties 22 and 24 would experience a view towards the works associated with Hillhead Road, the construction of the dualled A8 section and construction area adjacent to the Hillhead and A8 junction. The effect on properties 22 and 24 is judged to result in a ***moderate adverse*** effect during construction. Property 27 would experience a ***slight adverse*** effect with a view across the existing A8 towards the construction activity in this area.

The deposition of material leading towards Lisglass Road and the excavation of material further north would be visible from properties within Bruslee. Properties situated to the east of the Bruslee (38, 44, 58, 60, 62, 71, 74, 75 and 77) would experience close rear views towards the construction work and property 38 is also judged to experience a clear view towards the construction phase drainage area. The vegetation clearance at this location would open the view towards the construction activity and the gradual introduction of the new carriageway. These properties are judged to experience a ***substantial adverse*** effect during construction. Within this location, C2K Centre (66) is a commercial premise with a reduced level of visual sensitivity considered to experience a ***moderate adverse*** effect during construction.

The construction activity from properties situated to the west of Bruslee would be evident, (56, 57, 61, 65, 68 and 72) although filtered by roadside vegetation and adjacent properties. The effect on these properties during construction is judged to be ***slight adverse***. Property 49 experiences a more open view across the A8 towards the construction activity, judged to result in a ***moderate adverse*** effect.

Further north as the new carriageway realigns with the existing A8, properties 82, 84, 92 and 93 would have a clear close view towards the construction work, heightened by the removal of existing road side vegetation. The effect on these properties is judged to result in ***substantial adverse*** during construction. Properties along Glen Road (86, 88, 95, 97 and 98) increase in distance from the construction work but the removal of road side vegetation would open up views towards the traffic and construction work. Due to the orientation and proximity to the work, the effect on these properties is judged to be ***slight adverse*** during construction.

Further north near Rushvale Road, the removal of road side vegetation would expose the construction work to residential properties 99, 100, 101 and 102. These properties would experience a view towards an attenuation pond to the south of Rushvale Road and a temporary drainage construction area to the west of the A8 and north of Rushvale Road. These properties are judged to experience a ***moderate adverse*** effect during construction. The proposed Rushvale link road would also be constructed at this location, crossing a number of agricultural fields before connecting to the realignment work associated with the Calhame Road. Properties 104 and 105 in this location would experience clear rear aspect views towards the construction of the connection road and front aspect views towards the dualling of the A8 and temporary drainage construction area, resulting in a ***moderate adverse*** effect during construction. Set back from the Rushvale Road, property 106 would experience a filtered front aspect view toward the construction work along the A8 corridor and a view towards the Rushvale connection works, resulting in a ***slight adverse*** effect. Further north, property 108 would experience a view towards the construction work associated with Rushvale Road with a distant view towards the introduction of the Calhame Road grade separated junction, resulting in ***moderate adverse*** effect during construction.

Properties in close proximity to the Calhame Road junction would experience varying levels of visual effect during construction as a result of the orientation, proximity and extent of existing screening vegetation. Properties 123 and 124 are judged to experience a ***substantial adverse*** effect due to the close proximity to the construction of the embankment and bridge structure and the contractors construction area to the east of the A8. Similarly property 116 would experience a ***substantial adverse*** effect during construction due to the removal of a proportion of existing vegetation associated with this property, exposing the property to views of the construction work and traffic on the existing A8. The introduction of the overbridge structure, the roundabout on embankment to the slip road arrangement would result in a ***substantial adverse*** effect to properties 113, 114, 115, 119 and 135 due to the clear view and proximity to the construction work and the contractors construction area. Properties 126 and 129 would experience an oblique view towards the construction of the junction arrangement resulting in a ***moderate adverse*** effect. Properties 109, 110, and 120 would experience a ***slight adverse*** effect due to the minor change to the overall perception of the view.

The online construction work would continue north requiring further vegetation removal and localised earth modelling resulting in a ***slight adverse*** effect to properties 151, 152, 153 and 160.

9.8.4.2 South of A57 Templepatrick Road Grade Separated Junction to Ballybracken Road Grade Separated Junction

The construction of the A8 Dualling at this location would begin to deviate from the existing A8 corridor into an agricultural landscape. The construction work would consist of substantial excavation work and the gradual introduction of a series of slip roads and roundabouts. The construction work would result in a ***substantial adverse*** effect to properties 164, 165, 174, 181, 183, 187 and 204 due to the large scale change to the overall perception and key characteristics of the views. A series of construction compounds would be situated to the north of the A57 Templepatrick Road junction towards the Church Road culvert. In addition to the construction of the junction arrangement, property 204 would experience a view towards the construction of the new carriageway crossing the landscape ascending on embankment towards Church Road.

Properties 198, 228, 231,267, 283 and 288 are situated to the east of the dual carriageway and would experience a view towards the construction of the A8 leading to the Church Road on embankment and the construction area to the east of the combined Ballynure Water and Church Road culvert. The view would be filtered by mature intervening trees resulting in a ***moderate adverse*** effect during construction.

The introduction of the Church Road culvert and the approaching embankments would be a visible component in the surrounding landscape. Properties 260 and 264 are situated in close proximity to the west of the culvert and would experience front elevation views towards the construction of the dualled A8 and close rear elevation views towards the construction of attenuation pond. Property 293 is set back from Church Road on the gentle slopes associated with the Six Mile Water. The view from these properties towards the construction work would change the overall perception of their existing view and would result in a ***substantial adverse*** effect during construction.

As Church Road ascends to the west, the properties become more elevated with views from higher ground across the surrounding landscape. Property 270 is situated in an elevated position with a view to the A57 Templepatrick Road junction, the new link road and the alignment leading towards the Church Road culvert. The view towards the dualled A8 construction, an attenuation pond and construction areas from this property would change the key characteristics of the view and result in a ***substantial adverse*** effect.

Property 257 is situated relatively close the construction of the Church Road culvert, although a view towards the work is likely to only be achievable from upper storey view, resulting in a ***moderate adverse*** effect during construction. Property 279 is situated in an elevated position with a view towards the construction work in the surrounding landscape, resulting in ***moderate adverse*** effect. The view from properties 244, 258, 259, 273 and 274 towards the construction of the overbridge, embankment and an attenuation pond would be apparent, but filtered by intervening vegetation, resulting in a ***slight adverse*** effect.

Further west, Church Road joins Ballycorr Road and continues south following the contours of the landscape. Residential properties line the road with many experiencing panoramic views from this elevated position. From the north of Ballycorr Road, properties situated on Logan Gardens (202, 205 and 206) with west facing views would experience an elevated view towards the Templepatrick Road junction and the realigned A57, together with the construction of the dualled A8, new link road and the attenuation ponds in the valley bottom. The effect on these properties within Logan Gardens is judged to be ***substantial adverse*** during construction.

As Ballycorr Road continues south, the views towards the construction work becomes more oblique. Properties 180, 182, 188, 189, 192, 193, 194 and 197 are judged to experience a readily noticeable change to the overall perception of the existing view, resulting in a ***moderate adverse*** effect. The view further south along Ballycorr Road from property 176 would be oblique with a minor change to the existing view, resulting in a ***slight adverse*** effect.

East of the Church Road/Ballycorr Road junction, Church Road continues east to join Lower Ballyboley Road. Similar to Ballycorr Road, Lower Ballyboley Road continues north following the contours of the landscape. Properties situated to the east of this road experience elevated views across the valley with the construction of the A57 Templepatrick Road junction, new link road and the new carriageway judged to be visible. The effect at this location on residential properties (300, 306, 308, 313, 314, 315, 317, 319, 320, 322) would experience ***moderate adverse*** effects during construction.

As Lower Ballyboley Road continues north, the view towards the construction activity would be intermittent with varying degrees of visibility and visual effect. The construction of the new carriageway at this location would include the excavation of material to a depth of approximately 10m. Properties would experience a view towards the construction plant and the gradual excavation of the material. As the excavation depth increases the construction work and plant would be less apparent. Properties 340, 339, 344, 345, 347, 362 and 370 would experience a ***slight adverse*** effect during the construction work. Further north, the cutting becomes shallower and the construction activity would become more visible in the surrounding landscape. From Lower Ballyboley road, property 355 is considered to experience a ***moderate adverse*** effect during construction.

To the east of the off-line new carriageway, property 290 is situated in close proximity to the construction work with a rear view across agricultural fields with construction plant and machinery visible. The effect on this property is judged to be ***substantial adverse*** during construction. Further east, properties 309 and 312 are situated adjacent to the work associated with Lismenary Road overbridge and the proposed construction compound. The effect on these properties is judged to be ***substantial adverse*** during construction. To the west of Lismenary Road overbridge, properties 324 and 333 would experience a close view towards the excavation work and similarly result in a ***substantial adverse*** effect during construction. Property 324 would also experience a front elevation views towards a construction areas to the north of the dualled A8 alignment. The orientation and increased distance from the works would result in a ***moderate adverse*** effect to properties 327 and 331. The view from properties 325 and 329 is primarily orientated towards the construction work associated to the Lismenary Road to the west with oblique views towards the construction area to the south, resulting in a ***slight adverse*** effect. Further north, property 342 would experience an oblique view to the east through vegetation to construction activity, resulting in a ***slight adverse*** effect. Properties 303 and 307, situated to the east boundary of Ballynure, would have filtered upper storey views towards the construction works resulting in a ***slight adverse*** effect during construction.

Further north as the construction of the new carriageway joins the existing A8 to the east of Ballynure, properties 311 and 316 would experience a view over the existing A8 towards the construction activity. Oblique views would also be apparent to the north towards the excavation associated with the Ballybracken Road junction. These properties are judged to experience a ***moderate adverse*** effect during construction.

9.8.4.3 South of Ballybracken Road Grade Separated Junction to Moss Road Junction

The new carriageway and the existing A8 would connect at grade, north of Ballynure at the Ballybracken Road junction. The radial slip roads associated with this junction would be constructed in cutting, leading to an underbridge to connect the east and west slip roads.

Properties 330, 332, 335, 348 and 350 are situated in close proximity to the construction work. During construction these properties are judged to have a clear view towards the construction areas, construction plant and excavation of material resulting in ***substantial adverse*** effect to the existing view during construction. East of the existing alignment the topography rises to Lower Ballyboley Road with properties 376, 377, 378 and 392 are judged to experience a noticeable deterioration to the existing view during construction, considered to result in a ***moderate adverse*** effect. The view from properties 381 and 387 in this location is slightly more filtered resulting in a ***slight adverse*** effect.

North of the Ballybracken Road junction the new carriageway would join the existing A8. At this location, the construction work would consist of online asymmetrical widening that would result in the removal of road side vegetation and a proportion of property front gardens to accommodate the construction work. At this location, properties 356 and 369 are judged to experience a ***moderate adverse*** effect during construction. Further north, 371, 372, 374 and 375 are situated in a slightly elevated position and are judged to experience some measurable change to the overall perception of the existing view, resulting in a ***slight adverse*** effect. Similarly, property 380 is enclosed by mature evergreen vegetation, filtering the view towards the construction work and resulting in a ***slight adverse*** effect.

Moving north, the construction work would result in the removal of garden vegetation to properties 384 and 394 to the east; both of these properties are judged to experience a ***substantial adverse*** effect during construction. On the north bound side, the work would consist of the construction of an embankment and the clearance of road side vegetation. The view from properties 386 and 399 towards the construction work would be open resulting in a ***moderate adverse*** effect. Properties beyond the immediate alignment in the location (382, 383, 385, 388, 390, 412, 414, 415, 416, 418, 419, 427, 440, 442, 453, 454, 455, 456, 462, 463, 466 and 468) would experience glimpse, filtered view towards the construction work that would result in a very minor to small scale change to the overall perception of the existing view, resulting in a ***slight adverse*** effect during construction. Properties 404, 405, 408 409 and 411, although situated beyond the immediate alignment, have extensive rear views from an elevated position with views towards the construction work, resulting in a ***moderate adverse.***

Further north, the construction work would continue online and consist of further asymmetrical widening. The effect on properties within Larne Close (to include 401, 406, 407, 410 and 413) would be incremental to the existing view, resulting in a ***slight adverse*** effect. At this location, the construction work is likely to result in the removal of garden vegetation associated with property 397, resulting in a clear view towards the construction work. The effect on this property is judged to be ***moderate adverse*** during construction.

Moving north from this location Ballygowan Road deviates from the A8 to the east with a number of the properties that line the road being situated in a slightly elevated position. Mature evergreen vegetation lines the rear of properties 422 and 424 providing an effect visual screen. The construction of a culvert at this location may result in the removal of a number of trees, resulting in a filtered view towards the construction work. The effect on these properties is judged to be ***slight adverse*** during construction. Further north, the removal of road side vegetation would expose a view towards the construction works and construction area from properties 431, 434, 436 and 438, resulting in a ***moderate adverse*** effect during construction. The view from neighbouring properties in the location (428, 429, 446, 420, 443, 433) are filtered by vegetation and properties and are assessed to experience a ***slight adverse*** effect during construction as a result in a small scale visual change to the overall perception of the view.

9.8.4.4 South of Moss Road Junction to Deerpark Road Junction

Properties in close proximity to the Moss Road junction, (458, 452, 459, 469, 470, 472) are judged to experience a ***substantial adverse*** effect during construction due to the clearance of vegetation and the gradual introduction of the junction embankments and overbridge. Properties 459, 469, 470 and 472 would also experience a view towards the construction areas in this location. The view from properties along Lower Ballyboley Road, west of the A8 alignment, are filtered by undulating topography and vegetation, although the gradual introduction of the junction would result in a ***moderate adverse*** effect to properties 465, 486, 478, 488, 479 and 482 as a result of the noticeable deterioration to the existing view. Similarly, east of the alignment along Ballygowan Road, properties 447 and 461 are judged to experience a ***moderate adverse*** effect during construction as a result in the removal of vegetation, the construction area and the gradual introduction of Moss Road overbridge and the approaching embankments.

The construction work would continue north online, resulting in further removal of road side vegetation. A proportion of the garden and vegetation associated with property 483 would be lost to accommodate the construction work, resulting in a readily noticeable change to the existing view and a ***moderate adverse*** effect.

A number of properties to the east and west of the alignment would experience filtered views towards the construction work that would result in a ***slight adverse*** effect (properties include 433, 437, 441, 487,480, 489, 467, 471, 473, 477, 498).

Ballygowan Road rejoins the A8 further north with a small cluster of properties located at the existing T-junction. The construction work to the north and south at this location would consist of cutting to the south and earthworks to form an embankment to the north. Properties 490, 491, 493, 494, 495 and 496 are judged to experience a ***moderate adverse*** effect during construction as a result of the removal of the existing vegetation and the earthworks within the vicinity. Property 503 is situated to the west on Deerpark Road and would experience a similar view towards the construction earthworks, resulting in a ***moderate adverse*** effect.

9.8.4.5 South of Deerpark Road Junction to Shane's Hill Road Roundabout

The Deerpark Road junction arrangement would be situated in close proximity to a number of properties. To the west of the existing A8, properties 507, 510 and 512 would experience direct views towards the radial slip roads that span from the A8 to the proposed roundabout to the east. The effect on these properties during construction is judged to be ***substantial adverse***. The view from properties 511 and 514, situated behind the above properties, is filtered by intervening vegetation and would experience a ***moderate adverse*** effect during construction. To the east of the alignment, properties 497, 499 and 500 are situated in a elevated position with a clear view towards the construction works and the introduction of the Deerpark Road junction arrangement. The effect on these receptors is judged to be ***substantial adverse*** during construction.

North of the Deerpark Road junction, the dualling would continue with further asymmetrical widening. As the construction work would pass Stewartstown Drive, the removal of the road side vegetation would expose the A8 to views from properties 518, 522 and 526, resulting in a readily noticeable change to the exiting view and experiencing a ***moderate adverse*** effect. Property 518 would also experience an oblique view to the construction compound located at the Deerpark Road junction and property 526 would experience a view towards the realignment work associated with Stewartstown Drive. Similarly, to the west of the A8, property 535 would experience a clear front view towards the construction work and site compound, resulting in a ***moderate adverse*** effect.

Property 525, situated to the east, and properties 539, 545, 556, 576 and 575 situated to the west, are located beyond the immediate A8 corridor with filtered views towards the construction activity. The effect on these properties is judged to be ***slight adverse*** during construction.

Further north on approach to Shane's Hill Road roundabout, the construction work would result in the removal of road side vegetation adjacent to property 544 and 547. Both properties would experience clear views towards the temporary drainage area and construction of the proposed attenuation pond. The properties would experience a readily noticeable change to the overall perception of the view, resulting in a ***moderate adverse*** effect during construction.

The introduction of Shane's Hill Road roundabout junction would result in a ***moderate adverse*** effect to property 551, 554 and 555 due to the proximity of the construction work and the removal of intervening vegetation. Properties 548, 549, 550 and 552 would also experience a clear close view towards the proposed construction compound in this area resulting in a ***substantial adverse*** effect during construction. Ballyrickard Road would be realigned during the construction, introducing a new road in to the front elevation view from properties 552 and 555.

The majority of the properties within the immediate vicinity of Shane's Hill Road junction would experience a ***slight adverse*** effect (to include 553, 551, 548, 549, 550, 560, 558, 569, 570, 571 and 573) as a result of the incremental change to the existing road corridor and the proposed realignment works.

9.9 Mitigation of Effects due to Construction

9.9.1 Landscape

The site compounds will be located along the construction corridor in close proximity to the proposed junctions and the dualled A8 alignment. Where possible the site compounds have been located within existing field compartments to limit the removal of vegetation. Root protection fencing should be installed at an appropriate distance from the existing vegetation to limit any damage from machinery and construction activity.

9.9.2 Visual

The visual effects arising from the construction activity, recorded in chapter 9.8.4 would vary along the route and at different times as the works progress. Construction work would be limited to specific working hours agreed by the local Council Authority to limit the night time effect of lighting on visual receptors.

9.10 Residual Effects due to Construction

As illustrated in Figure 1, the residual effects are the effects remaining after the mitigation measures have been fully implemented.

In the absence of any additional mitigation measures beyond those incorporated within the scheme design, the landscape and visual residual effects are judged to be the same as those identified within the construction phase assessment.

9.11 Cumulative Effect due to Construction

9.11.1.1 Landscape

The sensitive landscape receptors that contribute to defining the LCA's have been identified and assessed. Through the amalgamation of the effect on landscape receptors and the application of professional judgement, the effect on the LCA's has been determined.

This assessment process has been applied to assess the overall construction effect on the LCA's. Consequently, the combined cumulative effect on the LCA's has been addressed in chapter 9.8.2.1.

9.11.1.2 Visual

The duration of the construction work would range from a few weeks to the full extent of the construction period with varying degrees of visual effect, ranging from ***substantial to slight adverse***.

For specific visual receptors, the existing A8 corridor is a component within the existing view. At these locations, the construction of the A8 Dualling is considered to result in a ***slight to moderate adverse*** effect due to the measurable, small scale visual change to the overall perception and key characteristics of the view.

The effect on receptors in close proximity to the junction arrangements and the realigned A8 would result in ***moderate to substantial adverse*** effects as a result of the noticeable and significant deterioration to the existing view.

The cumulative visual effects arising from the construction is judged to be ***slight adverse*** with locally ***moderate*** *to* ***substantial adverse*** effects at specific locations (refer to **VIS, Appendix D2, and VIDs, Appendix D3, ES Volume II**).

9.11.2 Combined Effect of the A8 Dualling Scheme with Future Development

It is considered that the development sites listed in chapter 16.5.2.4 and **Appendix K, ES Volume II**, will have a ***negligible*** effect on the landscape and visual resource. Consequently, it is judged that any cumulative effect arising from the A8 Dualling scheme combined with the future development sites would be ***negligible***.

9.12 Assessment of Effects due to Operation

In accordance with DMRB, an assessment has been made of the effects in the winter of the operational assessment and in both the summer and winter in the design year, 15 years after operation. The VIDs **A8-S3-3118 to 3122, Appendix D3** and VIS, **Appendix D2, ES Volume II** record the assessments predicted for the operation and design year scenarios.

9.12.1 Assessment of Effects

This section assesses the landscape and visual effects arising from the Operational phase of the scheme, at year 1 scheme implementation.

The Landscape and visual effects are supplemented by the following figures:

- Drawings A8-S3-3100 to 3107 - Landscape Receptors;
- Drawing A8-S3-3108 - Topography;
- Drawing A8-S3-3110 – Photograph Location Plan;
- Drawings A8-S3-3111 to 3116 - Photographs;
- Drawing A8-S3-3117 ZTV;
- VIDs A8-S3-3118 to 3122;
- VIS – Appendix D2, ES Volume II; and
- Drawings A8-S3-3128 to 3135, Landscape Treatment Drawings.

9.12.2 Do Minimum Scenario – Landscape Assessment

9.12.2.1 Landscape Assessment

As described in chapter 9.4.4.2 (Do Minimum Scenario Baseline Assessment), the landscape baseline condition for the operational year is assumed to be consistent with chapter 9.8.1.1 (Assessment of Effects from Construction, Do Minimum Scenario Landscape Assessment).

9.12.3 Do Something Scenario – Landscape Effects

9.12.3.1 Landscape Effects

During operation the tree and hedgerow planting included as an integral part of the scheme, would be immature and make a limited contribution to mitigating the effects identified in the assessment of the scheme. The effectiveness of the planting would improve over time as it matures, and as the majority of the species employed would be deciduous, the planting would inevitably offer more effective screening in the summer than in the winter months.

9.12.3.2 Tardee and Six Mile Water Slopes Landscape

The existing A8 corridor has a certain capacity to accommodate the online widening within this LCA. However, the engineering structures would appear as prominent features within the landscape; these include the Calhame Road junction, Church Road culvert and Ballybracken Road junction. The planting proposed to integrate these features would be young and have a limited contribution in reducing the adverse effect. Church Road would be permanently severed by the dualled A8 and stopped-up either side of the alignment. A new link road would provide access east and west via the A57 Templepatrick Road junction, altering the existing road network.

The landscape features lost as a result of the construction work would include the hedgerow, walls and fences. These would be reinstated and although the hedgerow species would be young, the field pattern would begin to reform.

The land acquired for temporary construction areas and attenuations ponds would return to agricultural use on completion of the works. Where areas of land are not considered to be appropriate for agricultural use, as a result of the construction work or field severance for example, it is recommended that the land would be planted to contribute to the woodland character of the landscape.

Operational Effect

Due to the limited contribution that the planting would provide during operation, the landscape effect is considered to be the same as that identified for the construction period. The magnitude of change to this LCA is judged as moderate adverse during operation. This, in conjunction with the low to medium sensitivity of this LCA, would result in a ***moderate adverse*** landscape effect during operation.

9.12.3.3 Three and Six Mile Water Valley Landscape

Similarly to the Tardee and Six Mile Water Valley LCA, the A57 Templepatrick Road junction would remain as a permanent feature in the landscape and would result in a considerable increase to the existing A57/A8 junction arrangement. Furthermore, the realigned A57 Templepatrick Road and the cutting of the new carriageway would extend the road network into the surrounding agricultural landscape. The new link road would also remain as prominent feature and again increase the overall footprint of the road network within this LCA.

The land acquired for temporary construction areas and attenuations ponds would return to agricultural use on completion of the works. Where areas of land are not considered to be appropriate for agricultural use, as a result of the construction work or field severance for example, it is recommended that the land would be planted to contribute to the woodland character of the landscape.

The planting proposed to integrate the junction would be young and have a limited contribution to reducing the adverse effect, although the addition of ornamental planting at roundabouts could assist with integrating these new features.

Operational Effect

Similarly to the Tardee and Six Mile Water Valley LCA, the landscape effect is considered to be the same as that identified for the construction period. The magnitude of change to the LCA is judged to be moderate adverse during operation. This, in conjunction with the low to medium sensitivity, would result in a ***moderate adverse*** landscape effect during operation.

9.12.3.4 Larne Ridgeland Landscape

Moss Road junction, Deerpark Road junction and Shane's Hill Road roundabout would remain as permanent, incongruous features within the landscape. However, as noted above, the grass seed would begin to establish and integrate the cutting and embankment slopes and soften the appearance of the engineered surfaces in comparison to the construction period.

As the majority of the scheme would consist of online asymmetric widening throughout this LCA, the landscape has a certain capacity to absorb this change during operation. The hedgerows and road side vegetation lost during construction would be replanted to reform the current baseline condition and begin to repair the field boundaries.

Similarly to the previous landscape character areas, the land acquired for temporary construction areas and attenuations ponds would return to agricultural use on completion of the works. Where areas of land are not considered to be appropriate for agricultural use, as a result of the construction work or field severance for example, it is recommended that the land would be planted to contribute to the woodland character of the landscape.

Operational Effect

As noted previously, in year one the proposed environmental design incorporated into the dualling scheme would be young and have a limited contribution to reducing the adverse effects. Consequently, the effect on this LCA during operation is judged to be the same as the construction effect, resulting in a ***slight adverse*** effect.

9.12.3.5 Carrickfergus Upland Pastures

As noted in chapter 9.8.2.5, views towards the A8 are limited by intervening vegetation, properties and undulating landform. Limited areas with localised views towards the A8 are predominantly backclothed by rising ground towards the Larne Basalt Moorland LCA and AONB. In this context, the existing A8 is a small component of the view and consequently the A8 has a limited influence within this LCA.

Operational Effect

With due regard to the proximity of the dualling scheme, together with the limited views towards the A8 corridor, it is judged that the magnitude of change would result in 'no change' to this LCA. In the absence of any change, this LCA would experience a ***neutral*** effect during operation.

9.12.3.6 Larne Basalt Moorlands

Similar to the Carrickfergus Upland Pastures LCA, the views towards the new carriageway would be limited by intervening vegetation, properties and undulating landform. Areas with localised views towards the A8 are predominantly backclothed by rising ground towards the Carrickfergus Uplands Pastures LCA. In this context, the existing A8 is a small component of the view and consequently the A8 has a limited influence within this LCA.

Operational Effect

With due regard to the proximity and limited views towards the A8 corridor, it is judged that the magnitude of change would result in 'no change' to this LCA. In the absence of any change, this LCA would experience a ***neutral*** effect during construction.

9.12.4 Do Minimum Scenario – Visual Assessment

As described in chapter 9.4.4.2 (Methodology for Assessment of Effects due to Operation and Construction) the Do Minimum Visual Assessment during operation would be consistent with chapter 9.8.3.1 (Assessment of Effects due to Construction, Do Minimum Scenario Visual Assessment).

9.12.5 Do Something Scenario – Visual Effects

Visual effects in the operational period would arise from the loss of existing vegetation, earthworks and views of the road and the associated components, to include lighting, signage, structures and traffic movement. The operational assessment seeks to assess these components against the existing baseline conditions.

Notwithstanding this, the visual magnitude of change between the construction assessment and the operational assessment is judged to be negligible in comparison, with the exception of views towards temporary construction areas and temporary attenuation ponds. Consequently, although the visual intrusion may differ, for the majority of the visual receptors the construction effects are judged to be consistent with the operational effects.

On completion of the construction work, it is anticipated that the land acquired for temporary construction areas and attenuations ponds would return to agricultural use. Where areas of land are not considered to be appropriate for agricultural use as a result of the construction work or field severance for example, it is recommended that the land would be planted to contribute to the woodland character of the landscape.

In accordance with DMRB guidance, field surveys were conducted to record the following for each receptor:

- The receptor location;
- A general description of the receptor to include the building type, structure, roof material and aspect;
- The characteristic of the existing view;

- A description of the anticipated view at year 1 of scheme implementation (operation); and
- An assessment of the significance of effect at winter Year 1 (operation).

This information for each receptor is recorded in the VIS (**Appendix D2, ES Volume II**). The location of each receptor is recorded in the VIDs **A8-S3-3118 to 3122, Appendix D3, ES Volume II**).

A summary of the visual effects arising at the operational phase of the A8 Dualling is provided below.

9.12.5.1 B95 Coleman's Corner Roundabout to South of A57 Templepatrick Road Grade Separated Junction

Properties identified to experience substantial adverse effects during construction would continue to experience ***substantial adverse*** effects during operation (properties include 38, 44, 58, 60, 62, 71, 74, 75, 77, 82, 84, 92 and 93). The planting to reduce the adverse effects would be young and have a limited contribution to screening the views towards the dualling. Within this location, the C2K Centre (property 66) is a commercial premise with a reduced level of visual sensitivity resulting in a ***moderate adverse*** effect during operation.

Properties 22, 24 and 25, situated adjacent to Coleman's Corner would continue to experience a ***moderate adverse*** effect during operation.

Properties situated to the west of Bruslee (56, 57, 61, 65, 68 and 72) were assessed to experience slight adverse effect during construction. During operation, the A8 traffic would be relocated approximately 100m to the east of the properties. Although it is anticipated that these properties would experience a filtered view towards the new carriageway in operation, the relocation of the A8 is judged to result in a ***slight beneficial***. Property 49 would experience a view towards the new carriageway in operation resulting in a ***slight adverse*** effect.

Further north near Rushvale Road, it is anticipated that the construction areas will return to agriculture, although properties 99, 100, 101 and 102 would continue to experience a view towards an attenuation pond to the south of Rushvale Road, resulting a ***slight adverse*** effect during operation. Further north, properties 104, 105 and 108 would continue to experience a clear view towards the Rushvale link road and the new carriageway, resulting in a ***moderate adverse*** effect during operation.

Further north, the Calhame Road junction would be a prominent feature in the landscape that would alter the existing view from a number of residential properties. The properties assessed to experience a substantial adverse effect during construction would continue to experience a ***substantial adverse*** effect during operation as a result of the permanent change to the overall perception of the views (Properties include 113, 114, 116, 115, 119, 123, 124 and 135). Due to the oblique nature of the view from property 126 and 129, the junction arrangement would result in a ***moderate adverse*** effect during operation.

Properties assessed to experience a slight adverse effect during construction would continue to experience a ***slight adverse*** effect during operation as a result of the limited screen that the young planting would provide..

Refer to the VIS and the VIDs (A8-S3-3118 to 3122), Appendix D, ES Volume II for a description of the view from each property.

9.12.5.2 South of A57 Templepatrick Road Grade Separated Junction to Ballybracken Road Grade Separated Junction

The A57 Templepatrick Road junction would continue to result in a ***substantial adverse*** effect to properties 164, 165, 174, 181, 187 and 204 as a result of the large scale change to the overall perception and key characteristics of their view. Properties situated to the east of the new carriageway, to the west boundary of Ballynure (198, 228, 231,267 283 and 288) would continue to experience a view towards the A57 junction and the new carriageway leading to Church Road culvert. The view would be filtered by mature intervening trees resulting in a ***moderate adverse*** effect during operation.

Properties 260 and 264 are situated on Church Road in close proximity to the west of Church Road culvert.. Property 293 is set back from Church Road on the gentle slopes associated with the Six Mile Water. The Church Road culvert, scheme alignment and the attenuation ponds would permanently change the overall perception and key characteristics of the view from these properties, resulting in a ***substantial adverse*** effect during operation.

As Church Road ascends to the west, the topography becomes elevated with views from higher ground across the surrounding landscape. Property 270 is situated in an elevated position with a view towards the A57 junction and new link road, an attenuation pond and the alignment leading towards Church Road culvert, resulting in a ***substantial adverse*** effect during operation. Properties 257 and 279 are situated on Church Road in an elevated position as the road ascends to the west. Similarly to the construction effect, during operation, both properties are judged to experience a ***moderate adverse*** effect. Properties 244, 258, 259, 273 and 274, also situated on Church Road, would experience a slightly more filtered view in comparison to 257 and 279, resulting in a ***slight adverse*** effect during operation.

Church Road joins Ballycorr Road to the west and Lower Ballyboley Road to the east, both of which follow the contours of the landscape on higher ground. The visual effects on properties situated on these roads would be consistent with the construction effects due to their elevated position and the permanent nature of the junction arrangements and off-line sections of the new carriageway. Properties 202, 205 and 206 within Logan's Gardens would continue to experience a ***substantial adverse*** effect, with properties 180, 182, 188, 189, 192, 193, 194 and 197 judged to experience a readily noticeable change to the existing view, resulting in a ***moderate adverse*** effect. Further south along Ballycorr Road, property 176 would experience oblique views, resulting in a ***slight adverse*** effect. A number of properties along Lower Ballyboley Road (300, 306, 308, 313, 314, 315, 317, 319, 320, 322) would continue to experience an elevated view towards the new carriageway, judged to result in a ***moderate adverse*** effect. As the new carriageway crosses the landscape in a deep cutting, road traffic would be less apparent, resulting in ***slight adverse*** effect to properties 340, 339, 344, 345, 347, 362 and 370. Further north, the cutting would become shallower and the carriageway traffic would become more visible in the surrounding landscape.

From Lower Ballyboley Road, property 355 is considered to experience a ***moderate adverse*** effect during operation.

Similarly, properties situated in close proximity to the new carriageway (290, 309, 312, 324, 333) would continue to experience a ***substantial adverse*** during operation due to the permanent change to the existing views. To the west of the realigned Lismenary overbridge, the orientation and increased distance from the new carriageway would result in a continued ***moderate adverse*** effect to properties 327 and 331.

Further north, as the new carriageway joins the existing A8, properties 311 and 316 would continue to experience a view over the existing A8 towards vehicles on the new carriageway. Oblique views would also be apparent to the north towards the Ballybracken Road junction. These properties are judged to experience a ***moderate adverse*** effect during operation.

As the replacement planting would be young, properties in this vicinity judged to experience a slight adverse effect during construction, would continue to experience a ***slight adverse*** effect during operation (properties include 303, 307, 325, 329 and 342).

9.12.5.3 South of Ballybracken Road Grade Separated Junction to Moss Road Junction

Properties 330, 332, 335, 348 and 350 are situated in close proximity to the Ballybracken Road junction. On completion of the construction work, these properties would continue to experience a clear view towards the new carriageway alignment and the junction arrangement, permanently altering the existing view from these properties and resulting in a ***substantial adverse*** effect during operation. Further west of Ballybracken Road junction, properties 376, 377, 378 and 392, situated on Lower Ballyboley Road would continue to experience a view of the junction arrangement and the new carriageway, resulting in a ***moderate adverse*** effect.

North of the Ballybracken Road junction the dualling would join the existing A8 and continue north along the existing A8 alignment. The planting at this location would be young and have a limited contribution to reforming the existing field pattern and landownership boundaries. Within this vicinity, properties 356 and 369 would continue to experience a ***moderate adverse*** effect during operation.

Further north the removal of garden vegetation associated with properties 384 and 394 to accommodate the new carriageway would result in the edge of the alignment being approximately 13m closer to these residential properties. The replacement vegetation would only provide a limited contribution to reducing the effect; consequently the effect would remain as ***substantial adverse*** during operation. Similarly, the replacement vegetation would not reduce the visual effect to properties 386 and 399 by the operational period and as a result, the visual effect would remain as ***moderate adverse*** during operation.

Properties 404, 405, 408, 409 and 411, situated beyond the immediate alignment on Braepark Road, have extensive rear views from an elevated position. The effect during operation is judged to be ***moderate adverse***, consist with the construction effect.

Further north along the dualling within Larne Close, the removal of garden vegetation associated with property 397 would be replanted, although the operation of the dualling would remain as a ***moderate adverse*** effect.

As Ballygowan Road deviates from the A8 to the east, the removal of road side vegetation would expose views towards the new carriageway, resulting in a ***moderate adverse*** effect to 431, 434, 436 and 438. Properties in this vicinity judged to experience a slight adverse effect during construction, would continue to experience a ***slight adverse*** effect during operation due the limited contribution the planting would have on reducing the effect (to include 303, 307, 325, 329, 342, 371, 372, 374, 375, 380-383, 385, 387, 388, 390, 401, 406, 407, 410, 412-416, 418-420, 422, 424, 427-429, 440, 442, 443,446, 453-456, 462, 463, 466, and 468)

For a description of the visual effect arising at operation, refer the VIS and the VIDs, Appendix D, ES Volume II.

9.12.5.4 South of Moss Road Junction to Deerpark Road Junction

During operation, Moss Road junction would remain as an incongruous feature in the landscape although it is anticipated that the construction areas at this location would return to agricultural use. The ***substantial adverse*** effects identified during the construction phase would continue as a result of the large scale permanent change to the existing view (properties include 458, 452, 459, 469, 470 and 472).

The properties along Lower Ballyboley Road, west of the A8 alignment, (465, 486, 478, 488, 479 and 482), would continue to experience a ***moderate adverse*** effect during operation, although the view would be partially filtered by undulating topography and vegetation. Similarly, east of the alignment along Ballygowan Road, properties 447 and 461 would continue to experience a ***moderate adverse*** effect due the replacement planting providing a limited visual screen in the early years. The replacement vegetation associated with property 483 would also be young and have a limited contribution to reducing the effect, remaining as ***moderate adverse*** during operation.

Further north properties situated on Ballygowan Road (490, 491, 493, 494, 495 and 496) to the east, and property 503 on Deerpark Road to the west, would continue to experience a ***moderate adverse*** effect during operation as a result of the removal of vegetation to accommodate the scheme.

Properties in this vicinity judged to experience a slight adverse effect during construction, would continue to experience a ***slight adverse*** effect due to the limited contribution the planting would have in reducing the effect.

For a description of the visual effect arising at completion, refer the VIS and the VIDs, Appendix D, ES Volume II.

9.12.5.5 South of Deerpark Road Junction to Shane's Hill Road Roundabout

Deerpark Road junction arrangement would be situated in close proximity a number of properties. The scale and nature of the junction would result in a permanent change to properties 507, 510 and 512, due to the clear views towards the radial slip roads that span from the new carriageway. The effect on these properties is judged to remain as ***substantial adverse*** during operation. The view from property 511 and 514, situated behind the above properties, would be filtered by intervening vegetation and would continue to experience a ***moderate adverse*** effect during operation. On elevated ground to the east of the alignment, property 497, 499 and 500 would experience a clear view towards Deerpark Junction and the new carriageway in operation, resulting in a ***substantial adverse*** effect.

The removal of the road side vegetation adjacent to Stewartstown Drive would expose the A8 in views from properties 526, 522 and 518. The replacement vegetation would have a limited screening effect on completion and consequently the effect during operation would remain as ***moderate adverse***. Similarly, to the west of the A8, property 535 would continue to experience a clear front view towards the new carriageway during operation, resulting in a ***moderate adverse*** effect.

Further north on approach to Shane's Hill Road roundabout, properties 544 and 547 would experience clear views towards the new carriageway as a result of the removed vegetation during construction. The effect during operation is judged to be ***moderate adverse***.

Shane's Hill Road roundabout would be situated in close proximity to properties 551, 554, 552 and 555. The new carriageway, Shane's Hill Road roundabout and realigned Ballyrickard Road would be a permanent change to the view from these properties and, as the replacement planting would be young and achieve a limited visual screen, the properties would continue to experience a ***moderate adverse*** effect during operation. The realignment of Ballyrickard Road would also be a new feature in the front elevation view from properties 552 and 555.

Properties within the vicinity assessed to experience a slight adverse effect during construction, would continue to experience a ***slight adverse*** effect during operation due to the limited visual screen provided by the proposed planting within the early stages of plant establishment.

For a description of the visual effect arising at completion, refer the VIS and the VIDs in **Appendix D, ES Volume II**.

9.13 Mitigation of Effects due to Operation

As described in chapter 9.7, the A8 Dualling scheme has progressed with continuous collaboration between the design team and environmental specialists. Through this iterative multi-disciplinary design process, an environmental design has been developed as an integral part of the overall scheme design. These environmental measures have been assessed as part of the A8 Dualling scheme and are not considered to be additional mitigation measures.

Where planting cannot be provided to integrate the proposed bridge structures, or where structures are visually prominent in an elevated position, the bridge wing walls will receive a natural stone facing to reflect the local character of the landscape.

No additional mitigation measures are proposed beyond those measures included within the scheme design.

9.14 Residual Effects due to Operation

As illustrated in Figure 1, the residual effects are the effects remaining after the mitigation measures have been fully implemented.

In the absence of any additional mitigation measures beyond those incorporated within the scheme design, the landscape and visual residual effects are judged to be the same as those identified within the operational phase assessment.

9.15 Cumulative Effects

9.15.1 Landscape

The sensitive landscape receptors that contribute to defining the LCA's have been identified and assessed. Through the amalgamation of the effect on landscape receptors and the application of professional judgement, the effect on the LCA's has been determined.

This assessment process has been applied to assess the overall operational effect effect on the LCA's. Consequently, the combined cumulative effect on the LCA's has been addressed in chapter 9.12.1.

9.15.2 Visual

In specific views, the A8 corridor is already a component within the existing view. In the majority of these locations, the proposed A8 Dualling scheme is considered to result in a ***slight adverse*** to ***moderate adverse*** effect due to the small scale visual change to the overall perception and key characteristics of the view.

The effect on properties in close proximity to the junction arrangements and the realigned A8 have predominantly been assessed as a ***moderate*** to ***substantial*** **adverse** effects as a result of the noticeable or significant deterioration to the existing view.

The cumulative visual effect during the operational phase is judged to be ***slight adverse*** with locally ***moderate to substantial adverse*** effects at specific locations.

Refer to VIDs, A8-3119 to A8-3122, and VIS, Appendix D2, ES Volume II.

9.15.3 Combined Effect of the A8 Dualling Scheme with Future Development

It is considered that the development sites listed in chapter 15.5.2.4 and **Appendix K, ES Volume II** will have a ***negligible effect*** on the landscape and visual resource. Consequently, it is judged that any cumulative effect arising from the A8 Dualling scheme combined with the future development sites would be ***negligible***.

9.16 Assessment of Effects at Design Year

This section assesses the landscape and visual effects arising from the proposed scheme in the Design Year (15 years after the operational assessment).

The VIDs **A8-S3-3118 to 3122** and the VIS **Appendix D2, ES Volume II**, record the assessment of effects on visual receptors.

9.16.1 Do Minimum Scenario – Landscape Assessment

As described in chapter 9.4.4.2 (Do Minimum Scenario Baseline Assessment), the landscape baseline condition for the Design Year is assumed to be consistent with chapter 9.8.1.1 (Assessment of Effects from Construction, Do Minimum Scenario Landscape Assessment).

9.16.2 Do Something Scenario – Landscape Effects

For the purposes of the assessment it has been assumed that the tree and hedgerow planting included as an integral part of the A8 Dualling scheme, would have achieved a height of 4.5m by the Design Year. This assumption is based on predicted growth rates of 0.3m per annum which, given the application of appropriate planting and management techniques, is considered to be a conservative estimate. This predicted growth rate is based on experience from comparable highway schemes.

The effects in the Design Year on the LCA's are described in the following sections.

9.16.2.1 Tardee and Six Mile Water Slopes Landscape

The engineering structures would remain as prominent features within the landscape due to the localised changes to the topography; consequently the underlying landscape effect would still be apparent. The severance of Church Road would also result in a permanent change to the existing road network However, the planting proposed as an integral part of the scheme would have matured by the design year to help integrate the junction arrangement. A number of exposed bridge abutments would also receive a natural stone facing to reflect the local character.

The off-line section of the new carriageway to the north of Ballynure would remain as an incongruous feature cutting through the grain of the landscape. However, by the design year, the planting would again assist with integrating the cutting and embankment slopes and the replacement hedgerows would also redefine the network of agricultural fields.

By the design year the landscape treatment developed to integrate the alignment and reflect the rural character would have matured, softening the effect within this LCA. The magnitude of change to this LCA is assessed to be minor adverse. This combined with the low to medium sensitivity of this LCA, would result in a ***slight adverse*** effect by the design year.

9.16.2.2 Three and Six Mile Water Valley Landscape

Similar to the Tardee and Six Mile Water Valley LCA, the Templepatrick Road junction and new link road would remain as permanent features in the landscape and would result in a considerable increase to the existing A57 Templepatrick Road junction arrangement. However, the existing A57 has a certain capacity to accommodate the extension to the road network and by the design year (2031) the landscape treatment developed to integrate the alignment and reflect the rural character would have matured, softening the overall engineered appearance.

The magnitude of change to this LCA is assessed to be minor adverse. This combined with the low to medium sensitivity of this LCA, would result in a ***slight adverse*** effect by the design year.

9.16.3 Larne Ridgeland Landscape

Where the dualling consists of online widening, by the Design Year the landscape treatment would have matured to integrate the alignment and reflect the existing A8 conditions. However, the Moss Road junction and the Deerpark Road junction would remain as permanent, incongruous features within the landscape as a result of the localised, engineered variation in the natural topography. Consistent with the LCA's above, the planting proposed at the junctions would have matured by the design year to softening the overall appearance and assist with integrating the embankments and cutting slopes.

The magnitude of change to this LCA is assessed to be Negligible by the design year. This in conjunction with the medium sensitivity would result in a ***neutral*** effect with a locally ***slight adverse*** effect at junction arrangements.

9.16.3.1 Carrickfergus Upland Pastures

As noted in chapter 9.8.2.5, views towards the A8 are limited by intervening vegetation, properties and undulating landform. Limited areas with localised views towards the A8 are predominantly backclothed by rising ground towards the Larne Basalt Moorland LCA and AONB. In this context, the existing A8 is a small component of the view and consequently the A8 has a limited influence to this LCA.

With due regard to the proximity of the dualling scheme, together with the limited views towards the A8 corridor, it is judged that the magnitude of change would result in 'no change' to this LCA. In the absence of any change, this LCA would experience a ***neutral*** effect by the design year.

9.16.3.2 Larne Basalt Moorlands

Similar to the Carrickfergus Upland Pastures LCA, the views towards the new carriageway would be limited by intervening vegetation, properties and undulating landform. Areas with localised views towards the A8 are predominantly backclothed by rising ground towards the Carrickfergus Uplands Pastures LCA. In this context, the existing A8 is a small component of the view and consequently the A8 has a limited influence to this LCA.

With due regard to the proximity and limited views towards the A8 corridor, it is judged that the magnitude of change would result in 'no change' to this LCA. In the absence of any change, this LCA would experience a ***neutral*** by the design year.

9.16.4 Do Minimum Scenario – Visual Assessment

As described in chapter 9.4.4.2 (Methodology for Assessment of Effects due to Operation and Construction) the Do Minimum Visual Assessment for the Design Year is consistent with chapter 9.8.3 (Assessment of Effects due to Construction, Do Minimum Scenario Visual Assessment) Do Something Scenario – Visual Effects.

In accordance with DMRB guidance, field surveys were conducted to record the following for each receptor:

- The receptor location;
- A general description of the receptor to include the building type, structure, roof material and aspect;
- The characteristic of the existing view;
- A description of the anticipated view at 1 year of scheme implementation (operation); and
- An assessment of the significance of effect at winter year 1 and summer and winter at year 15 (design year).

The information for each receptor is recorded in the VIS (**Appendix D2, ES Volume II**). The location of each receptor is recorded in the VIDs **A8-S3-3118 to 3122, Appendix D3, ES Volume II**).

A summary of the visual effects at the design year of the A8 Dualling scheme is provided below.

9.16.4.1 B95 Coleman's Corner Roundabout to South of A57 Templepatrick Road Grade Separated Junction

A number of properties identified to experience substantial adverse effects during operation would continue to experience ***substantial adverse*** effects in the design year. This would be apparent to properties near the off-line section at Bruslee and within the vicinity of the Calhame Road junction (including properties 38, 44, 58, 59, 62, 71, 74, 75, 77, 82, 116, 123 and 124). Although the planting proposed as an integral part of the scheme would have matured by the design year, the scheme would result in a permanent change to the key characteristics of their view, predominantly due to the introduction of the highway features and foreshortening of their existing view. Similarly, C2K Centre (66) is judged to continue to experience a ***moderate adverse*** effect for this reason.

The visual effect on properties 22 and 24 would reduce from a moderate adverse effect to ***slight adverse*** as a result of the replacement planting reaching a comparable condition and size to the existing planting. Similarly, the effect on properties 27, 49, 86, 88, 100, 151, 152 and 153 would reduce from a slight adverse effect to ***no change.***

The planting would have matured by the design year to filter the view towards the new carriageway, reducing the effect on properties 84, 92, 93, 113, 114, 115,119 and 135 from a substantial adverse effect to a ***moderate adverse*** effect. Similarly, by the design year, the planting would assist with reducing the effect on properties

25, 104, 105, 108, 118, 126 and 129 from a moderate adverse effect to a ***slight adverse*** effect.

A number of properties judged to experience a slight adverse effect during operation, would continue to experience a ***slight adverse*** effect by the design year. The proposed planting would reduce the effect but the location proximity and orientation of a number of properties would result in a permanent change to the existing view. Properties include 94, 95, 96, 97, 98 99, 101, 102, 106, 109, 110 and 120.

Properties 67, 78, 70, 89 and 160 are located in elevated positions to the east of the new carriageway. It is anticipated that the reinstatement planting and the tree and shrub planting would provide an effective screen during the summer months. As the foliage falls during the winter months and the effectiveness of the screening planting is reduced, the properties are judged to experience a ***slight adverse*** effect in the design year.

Properties situated to the west of Bruslee (49, 56, 57, 61, 65, 68 and 72), assessed to experience a slight beneficial effect during operation, would continue to experience a ***slight beneficial*** effect by the design year as a result of the A8 traffic being relocated approximately 100m to the east of the properties. Although it is anticipated that these properties would experience a view towards the new carriageway in operation, the relocation of the new carriageway is judged to result in beneficial effect. The existing A8 at this location would be used as a local access road to residential properties.

Refer to the VIS (Appendix D2, ES Volume II) and the VIDs A8-S3-3118 to 3122, (Appendix D3, ES Volume II) for a description of the view from each property.

9.16.4.2 South of A57 Templepatrick Road Grade Separated Junction to Ballybracken Road Grade Separated Junction

By the design year the planting would soften the appearance of the A57 Templepatrick Road junction, new link road and the off-line section of the new carriageway to the north of Ballynure, however, the effect for a number of properties would remain as ***substantial adverse*** due to the proximity and large scale change to the existing view. These properties include 164, 181, 187and 290. Similarly, properties 260, 309, 312, 324 and 333 are judged to experience a ***substantial adverse*** effect, although due to the orientation and extent of the view, the planting is judged to assist with reducing the adverse effect from substantial adverse effect to moderate adverse effect in the summer months.

The planting would integrate the alignment and reduce the adverse operational effects from substantial adverse to ***moderate adverse*** for a number of properties (including 165, 174, 202, 205, 206, 204, 260, 264, 270 and 293) and reduce the moderate adverse effects to ***slight adverse*** effects by the design year (properties 267, 283, 288, 198, 311, 316, 331, 327, 355, 180, 182, 188, 188, 189, 192, 193, 197, 279, 228, 231 and 279).

Properties situated on elevated ground to the west, and properties with distant views from Ballynure to the east, would experience views across the landscape towards the A57 Templepatrick Road junction and the off-line new carriageway corridor. Due to the permanent change to the existing view, a number of these properties would continue to experience a ***moderate adverse*** effect by the design year (properties include 257, 300, 306, 308, 313, 314, 315, 317, 319, 320 and 322) Similarly, a number of properties would continue to experience ***slight adverse*** effect during the design year (properties include 259, 258, 273, 274, 339, 340, 244, 345, 347, 342 211, 213, 285, 303 and 307). However, intervening vegetation and the proposed planting are judged to filter the view towards the new carriageway during the summer months, reducing the moderate adverse effect to a ***slight adverse*** (properties 228, 231, 267, 283, 288). Similarly, a number of properties are assessed to experience ***no change*** due to the proposed planting providing an effective screen (properties 211, 213, 303, 258, 342, 285 and 344).

9.16.4.3 South of Ballybracken Road Grade Separated Junction to Moss Road Junction

By the design year, the Ballybracken Road junction would be a less obtrusive feature in comparison to other junction arrangements due to the underbridge and radial slip road being in cutting. However, due to the proximity of property 330, 348 and 350, the effect is judged to remain as ***substantial adverse***, although property 348 is considered to experience a moderate adverse effect during the summer months. Similarly, properties 384 and 394 would continue to experience a ***substantial adverse*** effect due the increased proximity to the A8 dualling.

The proposed planting is judged to limit the view towards the junction from properties 332, 335 but the new carriageway scheme would still result in a noticeable change to the existing view, reducing the effect from a substantial adverse effect to a ***moderate adverse*** effect by the design year. Property 356 would remain as a ***moderate adverse*** effect due to the permanent loss of garden and the increased proximity to the new carriageway.

Further north the visual effects arising from the online new carriageway would reduce as the reinstatement planting and screen planting would be mature and reflect the current condition. The majority of properties judged to experience a moderate adverse effect during operation would experience a ***slight adverse*** effect by the design year (properties 369, 376, 378, 377, 392, 404, 405, 409, 408, 411, 366, 386, 397, 431, 399, 434, 436 and 438). Similarly, the planting removed to accommodate the new carriageway scheme would be replaced and reflect the current conditions, reducing the slight adverse effect during operation to ***no change*** by the design year (362, 370, 380-383, 385, 387, 388, 390, 396, 400, 406, 410, 412, 414-416, 418- 420, 422, 424,427, 440, 442, 451,453-456, 462, 463, 466 and 468,)

Properties 371, 372, 374, 375 and 376 are situated in an elevated position. The view of the new carriageway is judged to be incremental to the existing view of the A8, resulting in a permanent ***slight adverse*** effect. Similarly, further north, properties 401, 402, 407, 413, 428 and 429 would experience an incremental change to the existing view, resulting in a ***slight adverse*** effect.

9.16.4.4 South of Moss Road Junction to Deerpark Road Junction

During the design year, the Moss Road junction would remain as an incongruous feature in the landscape. The ***substantial adverse*** effects identified on properties

458, 452, 459, 469, 470 and 472 during operation would continue as a result of the large scale permanent change to the existing view. The view from property 452 and 459 would reduce to a moderate adverse effect during the summer months.

The Moss Road junction arrangement and new carriageway would remain as a readily noticeable feature in the view from properties 478, 483, 486, 488, 479 and 447 and would consequently continue to experience a ***moderate adverse*** effect during the design year. With the exception of property 483, the planting would assist with reducing the effect to slight adverse during the summer months.

Further north the visual effects arising from the online new carriageway would reduce as the reinstatement planting and screen planting would be mature and reflect the current condition. Properties 482, 490, 491, 493, 494 and 495 would reduce from a Moderate Adverse effect to a ***slight adverse*** effect. Similarly, properties 433, 437, 441, 480, 467, 461, 471, 473, 477 and 501 would reduce to 'no change' by the design year. Properties 503 and 496 are judged to continue to experience a ***moderate adverse*** effect, although planting would filter the view towards the new carriageway during the summer months, reducing the effect to slight adverse.

For a description of the visual effect arising at completion, refer the VIS and the VIDs, Appendix D, ES Volume II.

9.16.4.5 South of Deerpark Road Junction to Shane's Hill Road Roundabout

As with the previous junction arrangements, Deerpark Road junction would remain as a visible component in the landscape by the design year. Property 512 to the east of the new carriageway would continue to experience a view towards the radial slip roads that span from the new carriageway. The effect on this property is judged to remain as ***substantial adverse*** during the design year. Planting to the boundary of properties 507 and 510 and the land between the new carriageway and the quarry slip road is judged to reduce the effect on these properties from substantial adverse to ***moderate adverse*** during the design year. Property 511 situated on Deerpark Road behind property 507, would experience a ***moderate adverse*** effect during the design year, although this would reduce to Slight Adverse during the summer months. Property 514 within this location would experience a ***slight adverse*** effect during the design year.

To the east of the new carriageway, planting to the junction would reduce the visual effect on properties 500, 497 and 499, although, due to the elevated position of these properties, the effect is judged to be ***moderate adverse*** during the design year.

Further north the visual effects arising from the online new carriageway would reduce due to the reinstatement planting and screen planting reaching maturity and reflecting the current condition. Properties 518, 522, 526 and 551 would reduce from a moderate adverse effect to a ***slight adverse*** effect. Similarly, property 539, 545, 556, 576, 525, 594, 591 and 593 would reduce to ***no change*** by the design year.

The new carriageway would remain a permanent change to the existing view from properties 544 and 547 due to the removal of a proportion of the gardens and the increased proximity to the alignment. The effect on these properties is judged to remain as ***moderate adverse.***

Shane's Hill Road roundabout would be situated in close proximity to properties 551, 554, 552 and 555. The new carriageway, Shane's Hill Road roundabout and the realigned Ballyrickard Road would be a permanent change to the view from these properties. The replacement planting would assist with reducing the adverse effect on property 551 from a moderate adverse effect to a ***slight adverse***. However, due to the proximity of properties 554, 555 and 552, the effect during the design year would remain as ***moderate adverse.***

For a number of properties situated along the new carriageway near Shane's Hill Road roundabout, the view is judged to be incremental to the existing view of the A8, resulting in a permanent ***slight adverse*** effect (properties include 553, 550, 549, 548, 558, 560, 569, 570, 571 and 573).

Property 535 is situated approximately 40m back from the new carriageway alignment. The existing access road joining the A8 would be planted on completion of the construction work and by the design year the proposed planting would have matured. The view during the winter months is judged to be ***slight beneficial*** months, increasing to moderate beneficial in the summer months.

9.17 Mitigation of Effects at Design Year

As described in chapter 9.7 the A8 Dualling scheme has progressed with continuous collaboration between the design team and environmental specialists. Through this iterative multi-disciplinary design process, an environmental design has been developed as an integral part of the overall scheme design. These environmental measures have been assessed as part of the A8 Dualling scheme and are not considered to be additional mitigation measures.

No additional mitigation measures are proposed beyond those measures included within the scheme design.

9.18 Residual Effects at Design Year

As illustrated in Figure 1, the residual effects are the effects remaining after the mitigation measures have been fully implemented.

In the absence of any additional mitigation measures beyond those incorporated within the scheme design, the landscape and visual residual effects are judged to be the same as those identified within the design year assessment.

9.19 Cumulative Effects at Design Year

9.19.1 Landscape

The sensitive landscape receptors that contribute to defining the LCA's have been identified and assessed. Through the amalgamation of the effect on landscape receptors and the application of professional judgement, the effect on the LCA's has been determined.

This assessment process has been applied to assess the overall operational effect on the LCA's. Consequently, the combined cumulative effect on the LCA's has been addressed in chapter 9.16.

9.19.1.1 Visual

For a number of properties the A8 corridor is already a component within the existing view. For the majority of these properties the A8 Dualling scheme would result in ***no change to slight adverse*** effect by the design year.

The predominate effect on properties in close proximity to the junction arrangements and the realigned A8 have been assessed as experiencing a ***moderate to substantial adverse*** effect by the design year as a result of the noticeable or significant deterioration to the existing view.

The cumulative visual effect by the design year is judged to be ***no change*** to ***slight adverse*** with locally ***moderate to substantial adverse*** effects at specific locations.

For a description of the visual effect arising at completion, refer the VIS and the VIDs.

9.19.1.2 Combined Effect of the A8 Dualling Scheme with Future Development

It is considered that the development sites listed in chapter 16.5.2.4 and **Appendix K, ES Volume II** will have a ***negligible effect*** on the landscape and visual resource. Consequently, it is judged that any cumulative effect arising from the A8 Dualling scheme combined with the future development sites would be ***negligible.***

10 Cultural Heritage

10.1 Introduction

This chapter presents an assessment of the effects upon the local cultural heritage and archaeological environment as a result of upgrading a 14km stretch of the A8 Belfast to Larne Road from Coleman's Corner to the B100 (Ballyrickard Road), from single carriageway to dual carriageway standard.

The assessment sets out to identify the recorded cultural heritage assets and the potential archaeological resource that may exist within the scheme assessment area of the proposed scheme and its associated junctions.

10.2 Legislation and Guidance

This assessment has been undertaken based upon the guidance set out in the DMRB, Volume 11, Section 3 Part 2 HA 208/07 'Cultural Heritage'. The guidance is cohesive in incorporating the assessment of impacts that projects may have on archaeological remains, historic buildings and the historic landscape. This EIA was therefore undertaken in accordance with the DMRB using the significance criteria detailed in DMRB, Volume 11, Section 3 Part 2 HA 208/07 Cultural Heritage - Sub-Topic Guidance Annex 5: Archaeological Remains, Annex 6: Historic Buildings, Annex 7: Historic Landscape and is in accordance with the Institute for Archaeologists' 'Standard and Guidance for Archaeological Desk-Based Assessment'(IFA, 2001).

The following strategic and local legislation and guidance has also been considered in the undertaking of this assessment.

RDS

There are a range of policies relating to the caring of the environment in the RDS. The policies have been reviewed in relation to the proposed improvement scheme and pertinent policies are summarised below:

ENV 1.4	*Protect, enhance and encourage appreciation of the Region's landscapes;*
SPG-ENV 3	*To conserve the built environment;*
ENV 3.1	*Safeguard the archaeological resource;*
ENV 3.2	*Safeguard buildings of special architectural or historic interest;*
ENV 3.3	*Conserve the character of cities, towns and villages;*
ENV 3.5	*Promote the retention of vernacular buildings and industrial heritage features in urban and rural areas.*

Larne Area Plan 2010

The plan has been reviewed in relation to the proposed improvement scheme and pertinent policies and proposals are summarised below:

Policy MAN EN1 – The Department will protect areas of Significant Archaeological Interest from inappropriate development

Policy MAN EN2 – The Department will protect sites and the settings of monuments in state care or which may be taken into state care. Proposals for development in the vicinity of these monuments which would be likely to have an adverse affect on the sites or their settings will not be permitted. Particular attention will be paid to the impact of the proposal on:

1. *The area of historic landscape in which the site or monument functioned;*
2. *Critical views of and from the site or monument;*
3. *The access and public approaches to the site or monument; and*
4. *The understanding and enjoyment of the site or monument by visitors.*

Pre-Draft Antrim, Ballymena & Larne Area Plan 2016

The preparation of the Antrim, Ballymena and Larne Area Plan 2016 is part of an on-going programme being undertaken by the Department of the Environment (DoE) to provide full coverage of contemporary development plans for all Council areas in Northern Ireland. The Issues Paper, dated May 2002, has been reviewed in relation to its treatment of historic environment issues and the pertinent section is reproduced below:

'Conservation and Protection of the Environment

'5.7 The environment of the Plan area, similar to most of the environment of Northern Ireland, has been modified over the last 10,000 years by human impact. The Plan will seek to facilitate appreciation and care of the man-made elements of the environment of the Plan area.

5.7.1 There is a need to balance development pressures against the protection of the natural and man-made environment. A Countryside Assessment of the plan area will therefore be carried out in order to evaluate the assets and resources of the countryside and to inform and guide the formulation of plan policies and proposals. It will also take account of those national and international designations that protect the most valuable environments of the Plan area.

5.7.2 The Plan will also identify any local environmental features that should be considered for protection including: -

- Sites of Local Nature Conservation Importance;
- Areas of Significant Archaeological Interest;
- Areas of Archaeological Potential;
- Local Landscape Policy Areas;
- High quality agricultural land;
- Riverside locations which are wildlife corridors and have amenity and recreational value;
- River flood plains where development may have adverse consequences;
- The environment of the coastal zone which is comprised of the off-shore waters from just below low water, the beach and shoreline and an associated strip of land behind the shoreline which is subject to a number of particular development, economic and leisure pressures;
- Significant mature trees and woodland; and

- Historic parks, gardens and demesnes.

Planning Policy Statement 6 (PPS6): Planning, Archaeology and The Built Heritage (March, 1999)

PPS 6 sets out the planning policies for the protection and conservation of archaeological remains and features of the built heritage. The A8 scheme assessment area contains heritage features of regional and local importance. They include the Lowtown Rath which has been designated as a Scheduled Historic Monument (SHM) for its regional archaeological importance.

Policy BH 1 details the guidance and regulations for the Preservation of Archaeological Remains of Regional Importance and their Settings:

'*The Department will operate a presumption in favour of the physical preservation in situ of archaeological remains of regional importance and their settings. These comprise monuments in State Care, scheduled monuments and other important sites and monuments which would merit scheduling. Development which would adversely affect such sites of regional importance or the integrity of their settings will not be permitted unless there are exceptional circumstances.*'

Policy BH 2 deals with the Protection of Archaeological Remains of Local Importance and their Settings, states that:

'*Development proposals which would adversely affect archaeological sites or monuments which are of local importance or their settings will only be permitted where the Department considers the importance of the proposed development or other material considerations outweigh the value of the remains in question.*'

One grade B+ listed building (Christ Church, Ballynure) is present within the assessment area.

10.3 Scoping and Consultation

10.3.1 Scoping

An ES Scoping Report was issued in March 2010 to key statutory and non-statutory bodies outlining the approach, methodology, baseline conditions and expected effects of the scheme.

It was circulated to all stakeholders, offering them an opportunity to address the proposed methodologies for the EIA or to address issues that have not been adequately covered. A list of consultees is included in chapter 7.3.

10.3.2 Consultation

Additional consultation regarding the cultural heritage and archaeological environment was also conducted with NIEA through a number of ELG meetings as documented in chapter 7.2.2. Table 14 provides a summary of the key issues raised by NIEA Built Heritage throughout these meetings and individual one-to-one meetings and focus groups.

The consultation aimed to discuss the potential effects due to the dualling and the requirements for pre-construction mitigation. This consultation included representatives of the Arup design and environmental teams, NIEA, Roads Service and the Contractor to discuss the proposed evaluation and mitigation techniques, and when it would be proposed that these would take place.

Site visits were also undertaken with representatives of NIEA Built Heritage to discuss possible new sites, and also to agree locations where possible geophysical survey and trial trenching (archaeological testing) would be required to inform the preliminary and detailed design and assessment of the scheme.

10.4 Assessment Methodology

10.4.1 Methodology for Establishing Baseline Conditions

The assessment has been carried out in accordance with DMRB Volume 11 Section 3, Part 2 Annexes 5, 6 and 7, the Institute for Archaeologists' 'Standard and Guidance for Archaeological Desk-Based Assessment' (IFA, 2001), Code of Conduct (IFA, 2002), and PPS 6 where appropriate.

Following the recommendations given in DMRB Volume 11, Section 3, cultural heritage is taken as sites or other remains of archaeological interest, historic buildings (as identified in the Historic Buildings database maintained by NIEA), industrial heritage (as identified in the Industrial Heritage Record database also maintained by NIEA) and landscapes of historic and archaeological interest.

The baseline assessment included the following elements:

Documentary Research

The Archaeological Baseline Assessment comprised an examination of readily available published and unpublished written records, illustrations, maps and archaeological and geological records. Information was sourced from the Northern Ireland Sites and Monuments Record (NISMR) which is held and maintained by NIEA Built Heritage, and the Public Record Office Northern Ireland (PRONI).

Consultation

NIEA Built Heritage was consulted on the proposed A8 Dualling.

Site Walkover

The length of the proposed scheme was subjected to a site walkover to physically assess any possible specific or cumulative effects upon the cultural heritage resource. The site walkover was also undertaken to seek to identify previously unrecorded aspects of the cultural heritage resource which may be specifically affected by the proposed scheme.

10.4.2 Methodology for Assessment of Effects due to Construction

The assessment of impacts was undertaken according to the DMRB, Volume 11 Section 3, Part 2 Annexes 5, 6 and 7. The sections relevant to value, magnitude of impact and significance of effect are summarised as follows for ease of reference. This significance criteria has been used to determine the value, magnitude of impact and significance of effect due to the construction and operation of the scheme.

Value of Historical Assets

Table 27 and Table 28 describe the significance criteria as detailed within the DMRB to be used for the determination of value of archaeological and built heritage assets.

Table 27 **Value of Archaeological Assets**

Value	Typical Descriptors
Very High	World Heritage Sites (including nominated sites). Assets of acknowledged international importance. Assets that can contribute significantly to acknowledged international research objectives
High	Designated or undesignated assets that contribute to regional research objectives.
Medium	Designated and undesignated assets of local importance. Assets compromised by poor preservation and/or poor survival of contextual associations. Assets of limited value, but with potential to contribute to local research objectives.
Low	Assets with very little or no surviving archaeological interest.
Negligible	The importance of the resource has not been ascertained.

Table 28 **Value of Historic Buildings**

Value	Typical Descriptors
Very High	Structures inscribed as of universal importance as World Heritage Sites. Other buildings of recognised international importance.
High	Scheduled Monuments with standing remains. Grade A and Grade B+ Listed Buildings. Other listed buildings that can be shown to have exceptional qualities in their fabric or historical associations not adequately reflected in the listing grade. Conservation Areas containing very important buildings. Undesignated structures of clear national importance.
Medium	Grade B1 and B2 Listed Buildings. Historic (unlisted) buildings that can be shown to have exceptional qualities in their fabric or historical associations. Conservation Areas containing buildings that contribute significantly to its historic character. Historic Townscape or built-up areas with important historic integrity in their buildings, or built settings (e.g. including street furniture and other structures).
Low	Historic (unlisted) buildings of modest quality in their fabric or historical association. Historic Townscape or built-up areas of limited historic integrity in their buildings, or built settings (e.g. including street furniture and other structures).
Negligible	Buildings of no architectural or historical note; buildings of an intrusive character.

Magnitude of Impact

The approach used to assess significance of impact is determined by two variables; the importance of the receptor, as described in Table 27 and Table 28 and the magnitude of change upon the receptor (see Table 29). This takes into account the severity of impact of the proposals together with the vulnerability of the receptor to change.

Impacts upon the cultural heritage resource can derive from a variety of sources, and can be either direct or indirect.

Direct impacts are those that result from the scheme itself and include:

- Loss or physical damage to cultural heritage resources, for instance removal of buried remains by foundation excavations, or the partial or complete demolition of an upstanding monument or historic building;
- Visual, noise or vibration effects, for instance deriving from the construction of a new building adjacent to an historic structure. These types of direct impact may also contribute to an overall impact upon a site's 'setting'; and
- It should be noted that direct impacts are not necessarily permanent, nor are they necessarily always adverse. For example, landscaping incorporated into a scheme may have the effect of shielding a monument from the new development, and may even improve its setting; in this case the direct impact could be categorised as neutral or beneficial.

Indirect impacts are impacts that may have a palpable effect upon a monument or site, but not as a direct result of the scheme. They can include:

- Damage to waterlogged archaeological deposits located at a distance from a development as a result of de-watering;
- Impacts as a result of changes in traffic flows, for instance adverse impacts which occur to historic buildings that lie adjacent to a road that experiences increased traffic as a result of a scheme; and
- As with direct impacts, indirect impacts are not necessarily permanent, and can lead to beneficial effects upon the cultural heritage resource.

Table 29 summarises the type of change and its magnitude, according to the DMRB methodology.

Table 29 **Magnitude of Change**

Magnitude of Change	**Description of Change**
Major	Complete destruction/demolition of site or feature. Change to the site or feature resulting in a fundamental change in our ability to understand and appreciate the resource and its historical context and setting.
Moderate	Change to the site or feature resulting in an appreciable change in our ability to understand and appreciate the resource and its historical context and setting.
Minor	Change to the site or feature resulting in a small change in our ability to understand and appreciate the resource and its historical context and setting.
Negligible	Negligible change or no material change to the site or feature. No real change in our ability to understand and appreciate the resource and its historical context and setting.
No Change	No change

Significance of Effect

According to DMRB, significance of effect upon the cultural heritage resource is assessed according to the matrix approach described by Table 12. The effects may be either adverse or beneficial, depending on the nature of the impact. It should be noted that the assessment is made for the development without mitigation.

Evaluation of Effects

The scale and seriousness of the effects on the heritage resource in specific terms has been assessed as described by Table 30.

Table 30 **Evaluation Criteria**

Significance of Effect	The proposals would
Very large adverse	Partial or total loss of a site of Very High Importance.
Large adverse	Result in the total, or almost total, loss of heritage assets. Be highly intrusive and would seriously damage the setting of the heritage resource such that its context is seriously compromised and can no longer be appreciated or understood. Be strongly at variance with the form scale and pattern of a heritage resource or conservation area. Be in serious conflict with government policy for the protection of the heritage resource.
Moderate adverse	Be out of scale with or at odds with the scale pattern or form of the heritage resource or conservation area. Be intrusive in the setting (context) and adversely affect the appreciation and understanding of the resource. Result in loss of features such that their integrity of the heritage resource is compromised, but not destroyed. Be in conflict with local or regional policies for the protection of the heritage.
Slight adverse	Have a detrimental impact on the context of a heritage feature such that its integrity is compromised and appreciation and understanding of it is diminished. Not fit perfectly with the form scale pattern and character of a heritage resource or conservation area. Be in conflict with local policies for the protection of the local character of the heritage resource.
Neutral	Maintain existing historic features in the townscape. Have no appreciable impacts either beneficial or adverse on any known or potential heritage assets. Result in a balance of beneficial and adverse impacts. Not result in severance or loss of integrity context or understanding within a historic landscape. Not be in conflict with and do not contribute to policies for the protection or enhancement of the heritage.

Significance of Effect	The proposals would
Slight beneficial	Restore or enhance the sense of place of a heritage feature through good design and mitigation. Remove or mitigate visual intrusion (or other indirect impacts) into the context of heritage features such as that appreciation and understanding of them is improved. Not be in conflict with national regional or local policies for the protection of the heritage. Marginally enhance the integrity understanding and sense of place of a site or group of sites.
Moderate beneficial	Provide potential for significant restoration of characteristic features or their setting through the removal, relocation or mitigation of existing damaging or discordant impacts on the heritage resource. Contribute to regional or local policies for the protection or enhancement of the heritage resource. Enhance the integrity, understanding and sense of place of a site or group.
Large beneficial effect	Result in the removal relocation or substantial mitigation of very damaging or discordant existing impacts (direct or indirect) on the heritage. Result in extensive restoration or enhancement of characteristic features or their setting. Form a major contribution to government policies for the protection or enhancement of the heritage resource. Remove or successfully mitigate existing visual intrusion such as that the integrity understanding and sense of place of a site or group of sites is re-established.
Very Large beneficial effect	As 'Large beneficial' where the effect would be upon a site of Very High Importance

10.5 Limitations and Assumptions

10.5.1 Limitations

The assessment of the cultural heritage of the proposed A8 Dualling scheme is limited to the known recorded sites within the area as well as an examination of the local terrain.

The examination of the study area consisted of a study of cartographic and aerial sources, and reference to NIEA datasets of known sites. This was then followed by a number of site visits with NIEA Built Heritage representatives to identify areas of archaeological potential not listed within NIEA's datasets. These gave a good indication of the cultural heritage potential of the area and allow an assessment to be made regarding the possible archaeological features that could be encountered during the construction phase.

No geophysical surveys or intrusive investigations have been undertaken to inform this assessment; however the option to undertake geophysical survey of the proposed scheme in the future has been considered by this assessment.

10.5.2 Assumptions

This report was compiled using information from sources detailed in chapter 10.4.1 and it is assumed that this information is up to date and accurate.

It is also assumed that earthworks associated with the proposed scheme would cause large scale ground disturbance and that the works may impact upon previously unknown sub-surface archaeological features, if they exist.

These impacts include, but may not be limited to:

- Damage or disturbance by means of the actual construction process;
- The fragmentation of landscapes in which monuments are set and loss of the context of such groupings or sites, should they exist;
- Secondary impact to environmental factors, i.e. ground water levels or soil chemistry, with the resulting erosion of monuments or drying out of archaeological sites; and
- Visual impact to the settings of monuments, buildings and landscapes.

10.6 Baseline

This assessment examined a 500m wide corridor along either side of the route of the proposed A8 improvement scheme in line with guidance outlined in DMRB Volume 11, Section 3, Part 2 (HA208/07) Annex 5 Cultural Heritage Sub-Topic Guidance: Archaeological Remains. This assessment utilises information from the following resources which have been examined throughout the assessment process:

- Northern Ireland Sites and Monuments Record (NISMR) held by NIEA Built Heritage;
- Historic Buildings database held by NIEA Built Heritage;
- Industrial Heritage Record (IHR) held by NIEA Built Heritage;
- Historic Parks and Gardens Register maintained by NIEA Built Heritage;
- Battle Sites Register maintained by NIEA Built Heritage;
- Defence Heritage Record (DHP) maintained by NIEA Built Heritage;
- Aerial Photographs;
- Historic maps and plans held by NIEA Built Heritage;
- Historic maps, plans and documents held by the Public Record Office Northern Ireland (PRONI);
- Ordnance Survey maps;
- Topographic records held by Ulster Museum;
- Published archaeological books and journals; and
- Unpublished reports held by NIEA Built Heritage and elsewhere.

This EIA has examined the findings of earlier archaeological baseline assessments undertaken at Stages[62] 1 and 2 of the DMRB[18] assessment process for this scheme.

10.6.1 Heritage Features within the Scheme Assessment Area

Approximate historical periods are described and based on the information provided in Table 31.

Table 32 details the cultural heritage features which have been identified by the baseline research and are located within 500m of the proposed scheme. A value has also been assigned to each feature based upon the criteria described within Table 27 and Table 28. The locations of sites included in this assessment are shown on **Drawings A8-S3-3201 to A8-S3-3205, in ES Volume II, Appendix E**.

Table 31 **Definition of Archaeological Time Periods**

Time period	Approximate Date Range
Prehistoric	8000 BC – AD 400
Early Christian	AD 400 - 800
Early Medieval & Viking	AD 800 - 1166
Medieval	AD 1166 - 1536
Post Medieval/Early Modern	AD 1536 - 1691
Modern	AD 1691 - present

[62] See chapter 3.2 for details of process Stages.

Table 32 **Heritage Assets within 500m of the Proposed Scheme**

Site No. on Drawings	Data Set Name	Period	SMR No.	IHR Ref.	Subject Type	Protection	Grid Ref.	Value of Feature
1	Sites & Monuments Record	Uncertain	ANT 051:122	-	Cropmark	None	J31418831	Unknown
2	Sites & Monuments Record	Uncertain	ANT 051:123	-	Cropmark	None	J30928869	Unknown
3	Sites & Monuments Record	Early Christian	ANT 051:030	-	Souterrain	None	J31458855	Low
4	Sites & Monuments Record	Prehistoric	ANT 051:032	-	Cairn	None	J31398827	Low
5	Sites & Monuments Record	Early Christian	ANT 045:024	-	Rath & souterrain	None	J31799054	Low
6	Sites & Monuments Record	Early Christian	ANT 045:051	-	Rath & souterrain	None	J3191 (approx location)	Low
7	Industrial Heritage Records	Modern		07083:000:00	Mearne's bridge	None	J31399122	Low
8	Sites & Monuments Record	Early Christian	ANT 045:052	-	Souterrain	None	J31829250	Low
9	Sites & Monuments Record	Early Christian	ANT 045:053	-	Souterrain	None	J318925 (approx location)	Low
10	Sites & Monuments Record	Uncertain	ANT 045:128	-	Enclosure	None	J31739256	Unknown
11	Sites & Monuments Record	Early Christian	ANT 045:090	-	Rath & souterrain	None	J31839256	Low

Site No. on Drawings	Data Set Name	Period	SMR No.	IHR Ref.	Subject Type	Protection	Grid Ref.	Value of Feature
12	Sites & Monuments Record	Prehistoric	ANT 045:125	-	Findspot: Amber beads	None	J319925 (approx location)	Low
13	Sites & Monuments Record	Modern	ANT 045:119	-	Quarry	None	J31689279	Negligible
14	Sites & Monuments Record	Uncertain	ANT 045:054	-	Enclosure	None	J31769303	Unknown
15	Sites & Monuments Record	Uncertain	ANT 045:055	-	Enclosure	None	J3193	Unknown
16	Sites & Monuments Record	Early Christian	ANT 045:056	-	Souterrain	None	J3193 (approx location)	Low
17	Sites & Monuments Record	Uncertain	ANT 045:099	-	Enclosure	None	J30639346	Unknown
18	Industrial Heritage Records	Modern	-	07093:004:00	BALLYNURE STATION SITE: Midland Railways - MR (NCC) Doagh Branch	None	J30719369	Low
19	Industrial Heritage Records	Modern	-	07084:000:00	Hillis bridge	None	J31119369	Low
20	Industrial Heritage Records	Modern	-	07085:000:00	COTTON MILL: Beetling Mill site	None	J31369351	Low

Site No. on Drawings	Data Set Name	Period	SMR No.	IHR Ref.	Subject Type	Protection	Grid Ref.	Value of Feature
21	Sites & Monuments Record	Early Christian	ANT 045:016	-	Church, graveyard & souterrain (Christ Church, Ballynure)	Listed Building: Grade B+	J31589362	High
22	Sites & Monuments Record	Early Christian	ANT 045:116	-	Souterrain	None	J307940 (approx location)	Low
23	Sites & Monuments Record	Uncertain	ANT 045:059	-	Enclosure	None	J3194	Unknown
24	Sites & Monuments Record	Early Christian	ANT 045:058	-	Souterrain	None	J3194 (approx location)	Low
25	Industrial Heritage Records	Modern	-	07090:000:00	Bridge	None	J31499499	Low
26	Industrial Heritage Records	Modern	-	07093:002:00	Midland railway bridge	None	J31519496	Low
27	Sites & Monuments Record	Early Christian	ANT 046:043, 44, 45, 46, 47 (duplicate entries)	-	Souterrain	None	J3295	Low
28	Industrial Heritage Records	Modern	-	06780:044:00	Junction site: Ballymena - Larne Harbour Narrow Gauge Railway	None	J32519599	Low
29	Sites & Monuments Record	Uncertain	ANT 046:004	-	Enclosure	None	J33239555	Unknown

Site No. on Drawings	Data Set Name	Period	SMR No.	IHR Ref.	Subject Type	Protection	Grid Ref.	Value of Feature
30	Sites & Monuments Record	Uncertain	ANT 046:003	-	Enclosure	None	J33119636	Unknown
31	Sites & Monuments Record	Uncertain	ANT 046:002	-	Enclosure	None	J33139639	Unknown
32	Industrial Heritage Records	Modern	-	06780:021:00	Ballymena - Larne Harbour Narrow Gauge Railway	None	J33729717	Low
33	Sites & Monuments Record	Early Christian	ANT 040:050	-	Souterrain	None	J3497 (approx location)	Low
34	Sites & Monuments Record	Uncertain	ANT 040:019	-	Enclosure	None	J34329715	Unknown
35	Industrial Heritage Records	Modern	-	06780:022:00	Headwood Station Site: Ballymena – Larne Harbour Narrow Gauge Railway	None	J34229744	Low
36	Sites & Monuments Record	Early Christian	ANT 040:088	-	Souterrain	None	J34459746	Low
37	Industrial Heritage Records	Modern	-	06780:024:00	Ballymena-Larne Railway Bridge	None	J34799770	Low
38	Industrial Heritage Records	Modern	-	06962:000:00	Cotton mill: Flax Spinning Mill Site	None	J34889788	Low
39	Sites & Monuments Record	Early Christian	ANT 040:015	-	Rath & souterrain	None	J35809926	Low

Site No. on Drawings	Data Set Name	Period	SMR No.	IHR Ref.	Subject Type	Protection	Grid Ref.	Value of Feature
40	Sites & Monuments Record	Uncertain	ANT 040:065	-	Earthwork	None	J35939929	Unknown
41	Sites & Monuments Record	Uncertain	ANT 040:041	-	Holy well	None	J35369972	Unknown
42	Sites & Monuments Record	Early Christian	ANT 040:014	-	Rath & souterrain (Lowtown Rath)	Scheduled	J36059987	High
43	Industrial Heritage Records	Modern	-	06780:027:00	Railway siding	None	J36149966	Low
44	Sites & Monuments Record	Uncertain	ANT 040:047	-	Enclosure	None	D3600 (approx location)	Low
45	Unrecorded Feature (aerial photograph)	Uncertain	-	-	Cropmark	None	J318944 (approx location)	Unknown
46	Sites & Monuments Record	Uncertain	ANT 046:048	-	Ecclesiastical site	None	J3295 (approx location)	Low
47	Personal communication (landowner)	Early Christian	-	-	Souterrain	None	Ch 8+427	Low

10.6.2 Archaeological Background

10.6.2.1 Prehistoric

Within the scheme assessment area two areas of prehistoric activity have been recorded and are outlined in Table 33.

Table 33 **Prehistoric Sites**

Site Number	Site Description
Site 4	Cairn
Site 12	Findspot of amber beads

10.6.2.2 Early Christian

There are 16 areas of early Christian remains within the scheme assessment area. Throughout the corridor, there are 10 souterrains, 5 raths & souterrains, and 1 souterrain with a church. These are outlined in Table 34.

Table 34 **Early Christian Sites**

Site Number	Site Description
Site 3	Souterrain
Site 5	Rath and Souterrain
Site 6	Rath and Souterrain
Site 8	Souterrain
Site 9	Souterrain
Site 11	Rath and Souterrain
Site 16	Souterrain
Site 21	Church, graveyard and souterrain
Site 22	Souterrain
Site 24	Souterrain
Site 27	Souterrain
Site 33	Souterrain
Site 36	Souterrain
Site 39	Rath and Souterrain
Site 42	Rath and Souterrain (Lowtown Rath)
Site 47	Souterrain

10.6.2.3 Early Medieval & Viking

No early medieval & Viking remains are known to exist within the scheme assessment area, however it is possible that as-yet undiscovered remains dating from this period may exist within the scheme assessment area.

10.6.2.4 Medieval

No medieval remains are known to exist within the scheme assessment area, however it is possible that as-yet undiscovered remains dating from this period may exist within the scheme assessment area.

10.6.2.5 Post Medieval/Early Modern

No post medieval/early modern remains are known to exist within the scheme assessment area, however it is possible that as-yet undiscovered remains dating from this period may exist within the scheme assessment area.

10.6.2.6 Modern

Table 35 outlines the 13 sites featuring modern remains within the scheme assessment area.

Table 35 **Modern Sites**

Site Number	Site Description
Site 7	Mearnes Bridge
Site 13	Quarry
Site 18	Site of Ballynure Station- Ballymena to Larne harbor narrow gauge railway
Site 19	Hillis Bridge
Site 20	Site of Beetling Mill
Site 25	Bridge
Site 26	Midland Railway Bridge
Site 28	Site of junction- Ballymena to Larne harbor narrow gauge railway
Site 32	Ballymena to Larne harbor narrow gauge railway
Site 35	Site of Headwood Station - Ballymena to Larne harbor narrow gauge railway
Site 37	Bridge- Ballymena to Larne harbor narrow gauge railway
Site 38	Site of Flax Spinning Mill
Site 43	Railway siding

10.6.2.7 Uncertain

Table 36 details the 16 features of uncertain date throughout the scheme assessment area.

Table 36 **Uncertain Sites**

Site Number	Site Description
Site 1	Cropmark
Site 2	Cropmark
Site 10	Enclosure
Site 14	Enclosure
Site 15	Enclosure
Site 17	Enclosure
Site 23	Enclosure
Site 29	Enclosure
Site 30	Enclosure
Site 31	Enclosure
Site 34	Enclosure
Site 40	Enclosure
Site 41	Holy Well
Site 44	Enclosure
Site 45	Cropmark
Site 46	Ecclesiastical site

10.6.2.8 Historic Buildings

There is one historic building within the scheme assessment area. This is Christchurch, graveyard and souterrain (SMR No. ANT 045:016) which is located on Church Road in Ballynure to the west of the existing A8. This church was constructed between 1854-6 and consists of a Gothic Revival Church built in an early English style. It was designed by the architect Joseph Welland of Dublin and has been awarded Grade B+ listed protected status by the NIEA.

10.6.3 Maps Summary

To gain an understanding of the historic development of the overall landscape, all available OS maps from the early nineteenth century to present day were examined. For the terms of this report, specifically when considering mitigation, the scheme assessment area relates to a corridor extending for 500m on either side of the proposed scheme.

The first edition OS map, published in 1832, showed there was a road from Belfast to Larne (the current A8) set within a marginal landscape with few recorded field systems. The settlement of Ballynure was recorded, with mills (Sites 20, 38), a church (Site 21) and small scattered dwellings within its environs. Within the vicinity of the road (the existing A8), nine circular features (Sites 1, 3, 5, 29, 30, 31, 34, 39, 42) are recorded and labelled as forts, and industrial activity is evidenced by five quarries and gravel pits. Directly west of Ballynure, a trackway feature was noted on the site visit, at Ch4+930 (located south-west, north-east). This feature was evidenced on the first edition OS map in 1832, as part of a boundary feature.

The Second Edition OS maps (1857) showed the area of the proposed scheme during the middle of the 19th Century. This map edition was drawn in greater detail and included features such as regular field systems (many of which were shown to be tree lined) and three souterrains noted as caves (Sites 3, 39, 42), which were previously noted as forts. The main feature recorded on this survey, however, is the 'Ballyclare Branch Railway Line' in the south and 'Ballymena and Larne Railway Line' in the north (Site 32) with its associated Industrial Heritage sites – Ballynure Station (Site 18) and Ballyclare Junction (Site 28). Other heritage features include Mearne's Bridge (Site 7) which carried the Larne Road across the Green Burn and Hillis Bridge (Site19) which carries the Ballyeaston-Ballynure road across the Ballynure Water.

By 1905, the Third Edition OS maps showed the proposed scheme set within a predominately agricultural landscape adjacent to the railway line, now recorded as the 'Midland Railway (Northern Counties Section)'. Directly west of Ballynure, the church is now labelled as 'Christchurch' (Site 21).

The Fourth Edition OS maps (1932) showed very little change in the agricultural landscape, with the railway continuing to be the dominant feature. Notably, the 'Midland Railway' was now recorded as the 'Ballymena and Larne Branch' with the Kilwaughter siding (Site 43) noted in the north.

10.6.4 Aerial Photographic Survey

Aerial photographic evidence relating to the area was also examined by ADS. Various recorded features were visible on the aerial photographs although none of the sites were clearly discernible on this series of aerial photographs.

One previously unrecorded possible feature (Site 45) was noted on a 1:10,000 photograph, dated 1963, approximately 150m west of the proposed scheme at approximate Ch6+850. This was an oval cropmark located in a field of marginal ground, approximately 40m long by 30m wide. This earthwork could be a possible size for a rath - a settlement feature dating to the Early Christian period.

10.7 Environmental Design

As detailed within chapter 5.3.1, the A8 Dualling scheme has progressed with continuous collaboration between the design team and environmental specialists. Through this process, an environmental design has been developed as an integral part of the overall scheme design. These measures have been assessed as part of the scheme and are not considered to be additional mitigation measures.

The landscape proposals for the scheme include the replanting of hedgerow along the top of the cutting adjacent to Lowtown Rath. This planting would, over a period of 15 years, return the setting of the monument to a similar state as at present, notwithstanding the increased proximity of the A8 to the site.

10.8 Assessment of Effects due to Construction

The assessment of the effects due to the construction of the scheme upon cultural heritage was undertaken according to the methodology described in chapter 10.4. The results of the assessment are presented in Table 37.

Table 37 **Summary of construction effects upon cultural heritage resources identified within 500m of the proposed scheme.**

Site No. on Drawing	Subject Type	Designation	Grid Ref.	Value of Feature	Description of Impact	Magnitude of Impact	Significance of Effect
1	Cropmark		J31418831	Unknown	The site would have no intervisibility with the road; there would be no impacts upon the site or its setting.	No Change	Neutral
2	Cropmark		J30928869	Unknown	No Impact.	No Change	Neutral
3	Souterrain		J31458855	Low	The site would have no intervisibility with the road; there would be no impacts upon the site or its setting.	No Change	Neutral
4	Cairn		J31398827	Low	This site is not upstanding; therefore there would be no impact upon its setting.	No Change	Neutral
5	Rath & souterrain		J31799054	Low	The site lies approximately 500m from the A8 and it is judged that at this distance there would not be a significant impact upon the monument. However the new minor road connecting the B95 with Rushvale Road would pass 120m to the west of the monument. The noise and visibility of construction activities would result in an impact upon the setting of the monument.	Minor Adverse	Slight Adverse/ Neutral
6	Enclosure & souterrain		J3191 (approx location)	Low	The NIEA datasets identified some traces of this site, though no substantial remains. The site is located approximately 120m from the ralignedB95, to the west of the A8, however the site would experience negligible - no impacts as a result of the scheme.	Negligible/ No Change	Neutral
7	Mearne's bridge		J31399122	Low	This site is no longer extant and therefore would not experience impacts as a result of the scheme	No Change	Neutral

Site No. on Drawing	Subject Type	Designation	Grid Ref.	Value of Feature	Description of Impact	Magnitude of Impact	Significance of Effect
8	Souterrain		J31829250	Low	The NIEA datasets identified only traces of this site. It is located approximately 300m to the east of the scheme. The scheme would result in no change or negligible impact upon its setting.	Negligible/No Change	Neutral
9	Souterrain		J318925 (approx location)	Low	The NIEA datasets identified only traces of this site. It is located approximately 300m to the east of the scheme. The scheme would result in no change or negligible impact upon its setting.	Negligible/No Change	Neutral
10	Enclosure		J31739256	Unknown	The NIEA datasets identified only traces of this site. It is located approximately 250m to the east of the scheme. The date and value of this site is unknown, however the scheme would result in no change or negligible impact upon its setting.	Negligible/No Change	Neutral
11	Rath & souterrain		J31839256	Low	The NIEA datasets identified some remains of this site. It is located approximately 500m to the east of the scheme. The scheme would result in no change or negligible impact upon its setting.	Negligible/No Change	Neutral
12	Findspot: Amber beads		J319925 (approx location)	Low	There is no indication that the find spot is connected with an extant archaeological site. There would be no impact upon it as a result of the scheme.	No Change	Neutral
13	Quarry		J31689279	Negligible	This site was not located by the NIEA datasets , however as a modern feature it would not experience impacts upon its setting as a result of the scheme.	No Change	Neutral

Site No. on Drawing	Subject Type	Designation	Grid Ref.	Value of Feature	Description of Impact	Magnitude of Impact	Significance of Effect
14	Enclosure		J31769303	Unknown	No visible remains of this site were identified during the archaeological walkover. There would be no impacts as a result of the scheme.	No Change	Neutral
15	Enclosure		J3193	Unknown	No visible remains of this site were identified by the NIEA datasets. There would be no impacts as a result of the scheme.	No Change	Neutral
16	Souterrain		J3193 (approx location)	Low	This site was described by the NIEA datasets as 'destroyed'. There would be no impacts as a result of the scheme.	No Change	Neutral
17	Enclosure		J30639346	Unknown	The NIEA datasets identified some remains of this site. A proposed slip road would pass over this site on embankment, resulting in the destruction of any remains within this area	Major Adverse	Slight/Moderate Adverse
18	Ballynure station site:		J30719369	Low	Ballynure station closed in 1930, is no longer extant and would not be impacted by the scheme.	No Change	Neutral
19	Hillis bridge		J31119369	Low	Hillis Bridge would be demolished in order to construct the embankment for the Ballynure bypass.	Major adverse	Slight/ Moderate Adverse
20	Cotton Mill: Beetling Mill site		J31369351	Low	The site of the cotton mill would not be impacted by the scheme.	No Change	Neutral
21	Church, graveyard & souterrain (Christ Church,	Listed Building: Grade B+	J31589362	High	The scheme would not be visible from the church and therefore there would be no impact upon it.	No Change	Neutral

Site No. on Drawing	Subject Type	Designation	Grid Ref.	Value of Feature	Description of Impact	Magnitude of Impact	Significance of Effect
	Ballynure)						
22	Souterrain		J307940 (approx location)	Low	This site was not located by the NIEA datasets, however as due to its approximate location's distance from the scheme it would not experience impacts upon its setting as a result of the scheme.	No Change	Neutral
23	Enclosure		J3194	Unknown	This site was described by the NIEA datasets as 'destroyed'. There would be no impacts as a result of the scheme.	No Change	Neutral
24	Souterrain		J3194 (approx location)	Low	This site was described by the NIEA datasets as 'destroyed'. There would be no impacts as a result of the scheme.	No Change	Neutral
25	Bridge		J31499499	Low	This site would not be impacted by the scheme.	No Change	Neutral
26	Midland Railway Bridge		J31519496	Low	This site would not be impacted by the scheme.	No Change	Neutral
27	Souterrain		J3295	Low	No remains of this site were identified by the NIEA datasets.	No Change	Neutral
28	Junction site: Ballymena - Larne Harbour Narrow Gauge		J32519599	Low	This site would not be impacted by the scheme.	No Change	Neutral

Site No. on Drawing	Subject Type	Designation	Grid Ref.	Value of Feature	Description of Impact	Magnitude of Impact	Significance of Effect
	Railway						
29	Enclosure		J33239555	Unknown	No remains of this site were identified by the NIEA datasets.	No Change	Neutral
30	Enclosure		J33119636	Unknown	No remains of this site were identified by the NIEA datasets.	No Change	Neutral
31	Enclosure		J33139639	Unknown	No remains of this site were identified by the NIEA datasets.	No Change	Neutral
32	Ballymena - Larne Harbour Narrow Gauge Railway		J33729717	Low	A short section of the former route of the railway would be destroyed by the construction of the Moss Road Junction and widening of the A8.	Major Adverse	Slight/ Moderate Adverse
33	Souterrain		J3497 (approx location)	Low	This site was not located by the NIEA datasets. Its approximate location indicates that it may be not impacted by the construction of the proposed Moss Road Junction, however as its actual location is not known a worst-case scenario has been adopted .	Major Adverse	Slight/ Moderate adverse
34	Enclosure		J34329715	Unknown	No remains of this site were identified by the NIEA datasets.	No Change	Neutral
35	Headwood Station Site: Ballymena - Larne Harbour		J34229744	Low	This building is no longer standing, although the foundations have been used in the construction of a modern house. The site would be demolished by the scheme.	Major Adverse	Slight/ Moderate Adverse

Site No. on Drawing	Subject Type	Designation	Grid Ref.	Value of Feature	Description of Impact	Magnitude of Impact	Significance of Effect
	Narrow Gauge Railway						
36	Souterrain		J34459746	Low	No remains of this site were identified by the NIEA datasets.	No Change	Neutral
37	Ballymena-Larne Railway Bridge		J34799770	Low	This site would not be impacted by the scheme.	No Change	Neutral
38	COTTON MILL: Flax Spinning Mill site		J34889788	Low	This site would not be impacted by the scheme.	No Change	Neutral
39	Rath & souterrain		J35809926	Low	This site was identified as having substantial remains by the NIEA datasets. Existing tree cover would be maintained between the scheme and the monument, however there may be limited views of construction activities that would affect the setting of the site.	Minor adverse	Neutral/ Slight Adverse
40	Earthwork		J35939929	Unknown	The NIEA datasets identified some remains associated with this site however it is considered that the scheme would not impact upon its setting.	No Change	Neutral
41	Holy well		J35369972	Unknown	The NIEA datasets identify substantial remains associated with this monument, however it is considered that it would not	No Change	Neutral

Site No. on Drawing	Subject Type	Designation	Grid Ref.	Value of Feature	Description of Impact	Magnitude of Impact	Significance of Effect
					experience adverse impacts as a result of the scheme.		
42	Rath & Souterrain (Lowtown Rath)	Scheduled	J36059987	High	This monument would be located less than 20m from the scheme, and construction activities will result in impacts upon its setting	Moderate adverse	Moderate/ Large Adverse
43	Railway siding		J36149966	Low	This site would not be impacted by the scheme.	No Change	Neutral
44	Enclosure		D3600 (approx location)	Low	This site's approximate location places it out of sight of the scheme and therefore it is considered that there would be no impacts upon it.	No Change	Neutral
45	Cropmark		J318944 (approx location)	Unknown	This site has not been located by the NIEA dataset. This site lies outside of the scheme and would not be impacted by it.	No Change	Neutral
46	Ecclesiastical site		J3295 (approx location)	Low	This site has not been located by the NIEA datasets, however its approximate location places outside of the footprint of the scheme, and therefore it is considered that it would experience no impacts.	No Change	Neutral
47	Souterrain		CH 8+427 (Approx location)	Low	The approximate location of this site was provided by the landowner. The site is located outside of the footprint of the scheme, and therefore it is considered that it would experience no impacts.	No Change	Neutral

10.8.1 Effects upon Buried Archaeology due to Construction

The off-line sections of the proposed scheme, as well as proposed new junctions, would have the potential to impact upon as-yet undiscovered buried archaeological remains. While the location and nature of such remains is not known, it is considered that this would constitute a ***major adverse*** impact; as such remains would be destroyed by the construction of the scheme. It is considered that this would result in at least a ***moderate adverse*** significance of effect.

10.9 Mitigation of Effects due to Construction

The following section describes the mitigation proposed for significant impacts identified by the assessment. For the purposes of this assessment, it is considered that only impacts of slight/moderate adverse or higher would require mitigation.

10.9.1 Pre-construction Investigation

It is proposed that archaeological investigations would be undertaken prior to construction in order to identify as-yet undiscovered archaeological sites, and to ensure that appropriate recording of these is undertaken in advance of construction. Two survey methods are being considered:

Geophysical Survey (Magnetometry)

This survey would be undertaken for all areas of the scheme that lie outside of the existing A8 alignment. This technique is proposed to identify possible archaeological sites, and to enable investigation through trial trenching (below) to inform detailed mitigation proposals prior to construction; and

Archaeological Trial Trenching

This survey would be undertaken, where possible, to evaluate sites identified by aerial photography and geophysical survey as being of archaeological potential. It would also be used to investigate areas identified by walkover survey as being of potential due to their topographical location (for instance *fulachtaí fia* often lie adjacent to watercourses, and therefore such locations would be investigated by trial trenching, regardless of the results of any geophysical survey).

10.9.2 Proposed Site Specific Mitigation Measures

The following mitigation measures are proposed for the specific cultural heritage features impacted by the construction of the A8 Dualling.

Site 17 Enclosure

This site would be impacted by a new slip road on embankment. The mitigation for this impact would be preservation by record. The detailed methodology for this would be agreed with NIEA Built Heritage in advance of construction.

Site 19 Hillis Bridge

Hillis Bridge would be demolished by the scheme. It is proposed that the bridge and its setting would be recorded by photographic and measured survey prior to the construction of the embankment.

Site 32 Ballymena to Larne Harbour Narrow Gauge Railway

A short section of this site would be destroyed by the construction of the proposed Moss Road Junction and widening of the existing A8. The mitigation for this impact would be preservation by record. The detailed methodology for this would be agreed with NIEA Built Heritage in advance of construction.

Site 33 Souterrain

This site would potentially be destroyed by the construction of the proposed Moss Road Junction. The mitigation for this impact would be preservation by record. The detailed methodology for this would be agreed with NIEA Built Heritage in advance of construction.

Site 35 Site Former Headwood Station

Since the closure of the narrow gauge railway, this former station has been replaced by a modern house. However it is possible that elements of the former structure survive and therefore a buildings watching brief will be implemented during demolition to record any element of the historic structure that remain.

Site 42 Lowtown Rath

The assessment has identified that the increased proximity of the A8 to this monument would result in a moderate/large adverse effect upon its setting. The scheme includes reinstatement of hedgerow along the top of the proposed cutting. While this would not have an immediate effect in terms of mitigating the effect of the road on the monument, after a period of 15 years the hedgerow would have grown sufficiently partially to obscure the road from view. It is considered that in the long term the presence of the hedgerow would reduce the effect of the scheme upon the setting of the monument to slight adverse. No specific mitigation is proposed beyond the scope of the proposed landscape design.

10.9.3 As-yet Undiscovered Archaeology

As-yet undiscovered archaeological remains within the footprint of the scheme would be recorded in advance of construction by means of Strip-Map-Sample. Topsoil would be removed by machine under archaeological supervision and the location of archaeological features mapped using GPS survey. Following this NIEA Built Heritage will be consulted to determine which archaeological features will be investigated, and the level of detail to which this should be undertaken. The agreed strategy for each 'site' will subsequently be set out in a detailed Written Scheme of Investigation. Archaeological excavation will include palaeo-environmental sampling, and sampling of materials suitable for dating of archaeological deposits.

10.9.4 Post-excavation

All artefacts and samples derived from the excavations will be subject to post-excavation assessment and analysis. The results of the excavations and the post excavation analyses will be published upon completion, in a format to be agreed with NIEA Built Heritage.

10.10 Residual Effects due to Construction

The assessment has identified that buried archaeological remains would experience a moderate adverse impact as a result of construction. This impact would be permanent and irreversible. However, a programme of archaeological recording to be implemented prior to and during construction would mitigate these impacts to a degree, resulting in a slight adverse effect. For other sites above that were identified to experience slight/moderate adverse impacts, the proposed mitigation would reduce the residual impact of these to ***slight adverse***.

Lowtown rath and souterrain would experience a ***moderate/large adverse*** effect upon its setting during construction.

Without mitigation, Hillis Road Bridge would experience a ***slight/moderate adverse*** construction effect; with the proposed mitigation in place this would be reduced to ***slight adverse***

10.11 Assessment of Effects due to Operation

The assessment of the effects due to the operation of the scheme upon cultural heritage was undertaken according to the methodology described in chapter 10.4. The results of the assessment are presented in Table 38.

Table 38 **Summary of operational effects upon cultural heritage resources identified within 500m of the proposed scheme.**

Site No. on Drawing	**Subject Type**	**Designation**	**Grid Ref.**	**Value of Feature**	**Description of Impact**	**Magnitude of Impact**	**Significance of Effect**
1	Cropmark		J31418831	Unknown	The site would have no intervisibility with the road; there would be no impacts upon the site or its setting.	No Change	Neutral
2	Cropmark		J30928869	Unknown	No Impact.	No Change	Neutral
3	Souterrain		J31458855	Low	The site would have no intervisibility with the road; there would be no impacts upon the site or its setting.	No Change	Neutral
4	Cairn		J31398827	Low	This site is not upstanding; therefore there would be no impact upon its setting.	No Change	Neutral
5	Rath & souterrain		J31799054	Low	The site lies approximately 500m from the A8 and it is judged that at this distance there would not be a significant impact upon the monument. However the new minor road connecting the B95 with Rushvale Road would pass 120m to the west of the monument. The visible presence of the road, as well as noise and visibility of new traffic would result in an impact upon the setting of the monument.	Minor Adverse	Slight Adverse/ Neutral
6	Enclosure & souterrain		J3191 (approx location)	Low	The NIEA datasets identified some traces of this site, though no substantial remains. The site is located approximately 120m from the realigned B95, to the west of the A8, however the site would experience negligible - no impacts as a result of the scheme.	Negligible/ No Change	Neutral
7	Mearne's		J31399122	Low	This site is no longer extant and therefore would not experience impacts as a result of	No Change	Neutral

Site No. on Drawing	Subject Type	Designation	Grid Ref.	Value of Feature	Description of Impact	Magnitude of Impact	Significance of Effect
	bridge				the scheme		
8	Souterrain		J31829250	Low	The NIEA datasets identified only traces of this site. It is located approximately 300m to the east of the scheme. The scheme would result in no change or negligible impact upon its setting.	Negligible/No Change	Neutral
9	Souterrain		J318925 (approx location)	Low	The NIEA datasets identified only traces of this site. It is located approximately 300m to the east of the scheme. The scheme would result in no change or negligible impact upon its setting.	Negligible/No Change	Neutral
10	Enclosure		J31739256	Unknown	The NIEA datasets identified only traces of this site. It is located approximately 250m to the east of the scheme. The date and value of this site is unknown, however the scheme would result in no change or negligible impact upon its setting.	Negligible/No Change	Neutral
11	Rath & souterrain		J31839256	Low	The NIEA datasets identified some remains of this site. It is located approximately 500m to the east of the scheme. The scheme would result in no change or negligible impact upon its setting.	Negligible/No Change	Neutral
12	Findspot: Amber beads		J319925 (approx location)	Low	There is no indication that the find spot is connected with an extant archaeological site. There would be no impact upon it as a result of the scheme.	No Change	Neutral
13	Quarry		J31689279	Negligible	This site was not located by the NIEA datasets , however as a modern feature it	No Change	Neutral

Site No. on Drawing	Subject Type	Designation	Grid Ref.	Value of Feature	Description of Impact	Magnitude of Impact	Significance of Effect
					would not experience impacts upon its setting as a result of the scheme.		
14	Enclosure		J31769303	Unknown	No visible remains of this site were identified during the archaeological walkover. There would be no impacts as a result of the scheme.	No Change	Neutral
15	Enclosure		J3193	Unknown	No visible remains of this site were identified by the NIEA datasets. There would be no impacts as a result of the scheme.	No Change	Neutral
16	Souterrain		J3193 (approx location)	Low	This site was described by the NIEA datasets as 'destroyed'. There would be no impacts as a result of the scheme.	No Change	Neutral
17	Enclosure		J30639346	Unknown	This site would be destroyed by the scheme; therefore there will be no operational impacts upon it	N/A	N/A
18	Ballynure station site:		J30719369	Low	Ballynure station closed in 1930, is no longer extant and would not be impacted by the scheme.	No Change	Neutral
19	Hillis bridge		J31119369	Low	Hillis Bridge would be demolished by the construction of the scheme; therefore there will be no operational impacts upon it.	N/A	N/A
20	Cotton Mill: Beetling Mill site		J31369351	Low	The site of the cotton mill would not be impacted by the scheme.	No Change	Neutral
21	Church, graveyard & souterrain	Listed Building: Grade B+	J31589362	High	The scheme would not be visible from the church and therefore there would be no impact upon it.	No Change	Neutral

Site No. on Drawing	Subject Type	Designation	Grid Ref.	Value of Feature	Description of Impact	Magnitude of Impact	Significance of Effect
	(Christ Church, Ballynure)						
22	Souterrain		J307940 (approx location)	Low	This site was not located by the NIEA datasets, however as due to its approximate location's distance from the scheme it would not experience impacts upon its setting as a result of the scheme.	No Change	Neutral
23	Enclosure		J3194	Unknown	This site was described by the NIEA datasets as 'destroyed'. There would be no impacts as a result of the scheme.	No Change	Neutral
24	Souterrain		J3194 (approx location)	Low	This site was described by the NIEA datasets as 'destroyed'. There would be no impacts as a result of the scheme.	No Change	Neutral
25	Bridge		J31499499	Low	This site would not be impacted by the scheme.	No Change	Neutral
26	Midland Railway Bridge		J31519496	Low	This site would not be impacted by the scheme.	No Change	Neutral
27	Souterrain		J3295	Low	No remains of this site were identified by the NIEA datasets.	No Change	Neutral
28	Junction Site: Ballymena - Larne Harbour Narrow Gauge		J32519599	Low	This site would not be impacted by the scheme.	No Change	Neutral

Site No. on Drawing	Subject Type	Designation	Grid Ref.	Value of Feature	Description of Impact	Magnitude of Impact	Significance of Effect
	Railway						
29	Enclosure		J33239555	Unknown	No remains of this site were identified by the NIEA datasets.	No Change	Neutral
30	Enclosure		J33119636	Unknown	No remains of this site were identified by the NIEA datasets.	No Change	Neutral
31	Enclosure		J33139639	Unknown	No remains of this site were identified by the NIEA datasets.	No Change	Neutral
32	Ballymena - Larne Harbour Narrow Gauge Railway		J33729717	Low	A short section of the former route of the railway would be destroyed by the construction of the Moss Road Junction and widening of the A8. However all impacts will occur during construction	N/A	N/A
33	Souterrain		J3497 (approx location)	Low	This site was not located by the NIEA datasets. Its approximate location indicates that it may be not impacted by the proposed Moss Road Junction, however as its actual location is not known a worst-case scenario has been adopted. Any impacts upon this site would occur during construction.	N/A	N/A
34	Enclosure		J34329715	Unknown	No remains of this site were identified by the NIEA datasets.	No Change	Neutral

Site No. on Drawing	Subject Type	Designation	Grid Ref.	Value of Feature	Description of Impact	Magnitude of Impact	Significance of Effect
35	Headwood Station Site: Ballymena - Larne Harbour Narrow Gauge Railway		J34229744	Low	This building is no longer standing, although the foundations have been used in the construction of a modern house. The site would be demolished by the scheme, during construction. There would be no operational impacts.	N/A	N/A
36	Souterrain		J34459746	Low	No remains of this site were identified by the NIEA datasets.	No Change	Neutral
37	Ballymena-Larne Railway Bridge		J34799770	Low	This site would not be impacted by the scheme.	No Change	Neutral
38	COTTON MILL: Flax Spinning Mill Site		J34889788	Low	This site would not be impacted by the scheme.	No Change	Neutral
39	Rath & souterrain		J35809926	Low	This site was identified as having substantial remains by the NIEA datasets. Existing tree cover would be maintained between the scheme and the monument, however there may be limited views of the scheme that would affect the setting of the site.	Minor adverse	Neutral/ Slight Adverse
40	Earthwork		J35939929	Unknown	The NIEA datasets identified some remains associated with this site however it is considered that the scheme would not impact upon its setting.	No Change	Neutral

Site No. on Drawing	Subject Type	Designation	Grid Ref.	Value of Feature	Description of Impact	Magnitude of Impact	Significance of Effect
41	Holy well		J35369972	Unknown	The NIEA datasets identify substantial remains associated with this monument, however it is considered that it would not experience adverse impacts as a result of the scheme.	No Change	Neutral
42	Rath & Souterrain (Lowtown Rath)	Scheduled	J36059987	High	This monument would be located less than 20m from the scheme, which at this point would take the form of a cutting that brings the road closer to the site than at present, in addition to increasing the visibility of the road from the monument. This would result in an adverse impact on its setting. There would be no physical impact upon the scheduled area. The scheme includes proposals to reinstate hedgerow along the top of the new cutting. This will not immediately reduce the impact of the scheme, but will have this effect over a period of 15 years from scheme opening	Moderate adverse	Moderate/ Large Adverse, reducing to Slight Adverse after 15 years.
43	Railway siding		J36149966	Low	This site would not be impacted by the scheme.	No Change	Neutral
44	Enclosure		D3600 (approx location)	Low	This site's approximate location places it out of sight of the scheme and therefore it is considered that there would be no impacts upon it.	No Change	Neutral
45	Cropmark		J318944 (approx location)	Unknown	This site has not been located by the NIEA dataset. This site lies outside of the scheme and would not be impacted by it.	No Change	Neutral

Site No. on Drawing	Subject Type	Designation	Grid Ref.	Value of Feature	Description of Impact	Magnitude of Impact	Significance of Effect
46	Ecclesiastical site		J3295 (approx location)	Low	This site has not been located by the NIEA datasets, however its approximate location places outside of the footprint of the scheme, and therefore it is considered that it would experience no impacts.	No Change	Neutral
47	Souterrain		CH 8+427 (Approx location)	Low	The approximate location of this site was provided by the landowner. The site is located outside of the footprint of the scheme, and therefore it is considered that it would experience no impacts.	No Change	Neutral

10.11.1 Effects on Known Archaeology due to Operation

Lowtown Rath and souterrain would experience ***moderate/large adverse*** effect upon their setting upon the opening of the scheme. The monument would be located less than 20m from the scheme, which at this point would take the form of a cutting that brings the road closer to the site than at present, in addition to increasing the visibility of the road from the monument. This would result in an adverse impact on its setting however there would be no physical impact upon the scheduled area. The scheme includes proposals to reinstate hedgerow along the top of the new cutting. This will not immediately reduce the impact of the scheme, but will have this effect over a period of 15 years from scheme opening.

10.11.2 Effects upon the Historic Landscape due to Operation

The review of historical mapping as part of the baseline data assessment demonstrates that the landscape through which the scheme would run has remained largely unchanged, save for the natural expansion of Ballynure and the construction of the existing A8, for almost 180 years. However this landscape type is prevalent within the wider area, and is therefore not considered to be of particular significance; it is assessed as being of low (local) importance.

The proposed scheme would result in effects upon the landscape where the alignment of the dualling deviates from the existing A8, in particular around Ballynure. This impact is considered to be ***major adverse***, resulting in a ***slight/moderate*** adverse significance of effect.

10.12 Mitigation of Effects due to Operation

No specific mitigation is proposed for the effects identified due to operation as the scheme has been designed to include appropriate environmental design measures detailed in Table 6.

10.13 Residual Effects due to Operation

Due to the planting of the hedgerow along the new cutting adjacent to the Lowtown Rath, 15 years following the opening of the scheme the replaced hedgerow as specified in the environmental design would reduce the significance of this effect described in chapter 10.11.1 to ***slight adverse***.

10.14 Cumulative Effects

There are judged to be no cumulative effects on cultural heritage due to the scheme or other developments considered by the assessment.

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11 Geology and Soils

11.1 Introduction

This chapter presents an assessment of the effects on the geological environment as a result of the upgrading of 14km stretch of the A8 Belfast to Larne Road from Coleman's Corner to the B100 (Ballyrickard Road), from single carriageway to dual carriageway standard.

The objective of this chapter is to consider the constraints due to the presence of sites of geological value, geomorphological value, and areas of contaminated land. This includes sufficient assessment of the proposed scheme to identify any significant impact on geology and soils within the area and where appropriate any environmental issues associated with contaminated land. Impact upon human health and safety is also assessed.

11.2 Legislation and Guidance

This chapter has been prepared in accordance with DMRB Volume 11, Section 3, Part 11 'Geology and Soils' methodologies. According to guidance provided in DMRB Volume 11, Section 3, Part 11, the Geology and Soils chapter should refer to the potential impacts on agricultural soils. However this will be discussed further in chapter 16 'Community and Private Assets'.

In addition to the guidance provided in DMRB Volume 11, due reference will be made to the legislative framework relating to contaminated land as follows:

- The Groundwater Regulations (Northern Ireland) 2009

This legislation implements, in Northern Ireland, the Groundwater Daughter Directive 2006/118/EC on the protection of groundwater against pollution and deterioration and continues to implement Directive 2000/60/EC. The Groundwater Regulations (Northern Ireland) 2009 revoked the Groundwater Regulations (Northern Ireland 1998). The Directive seeks to prevent pollution of groundwater by preventing the direct or indirect discharge of 'hazardous' and 'non-hazardous' substances to groundwater, which broadly equate to the former List I and List II (under the former 1980 Directive and 1998 Regulations). Details of 'hazardous' and 'non hazardous' substances are provided in **Appendix F, ES Volume II**.

- The Environment (Northern Ireland) Order 2002

Part II of this Order makes provision for implementing Council Directives 96/61/EC concerning integrated pollution prevention and control (the IPPC Directive) and for otherwise preventing and controlling pollution.

The Northern Ireland Environment Agency (NIEA) designates Areas of Special Scientific Interest (ASSIs) under this Order to conserve special plants and animals or rare land features.

11.2.1 Soil Legislation

Current legislation on contaminated land is principally contained in the Waste and Contaminated Land (Northern Ireland) Order 1997**.** This legislation came into operation in March 1998 and implements the European Commission (ECom) Framework on Waste in Northern Ireland.

The legislation places a responsibility on the Department of the Environment for the identification of contaminated land and designation of special sites by consideration of whether:

- Significant harm is being caused; or there is a significant possibility of such harm being caused; or
- Pollution of waterways or underground strata is being or is likely to be caused.

The legislation also places a responsibility on enforcing authorities to require remediation, to determine appropriate persons to bear responsibility for remediation, to determine appropriate persons to bear responsibility for liability of contaminating substances which escape to other land, and provision of contaminated land registers.

The Part 3 of the Order contains the main legal provisions for the introduction of a contaminated land regime in Northern Ireland. The Order was enacted in 1997, but the regime is not yet in operation. However, in accordance with good practice this legislation was followed. The Part 3 regime aims to deal with the legacy of historically contaminated land through the “polluter pays” principle. This will ensure that, where possible, those who pollute the land will pay for its remediation so that it is “suitable for use”.

An important part of the proposed regime is the provision of technical guidance for regulators to assist them in the determination of contaminated land. The DOE have identified a paper produced by a Defra facilitated Soil Guideline Values (SGV) Task Force entitled, “Assessing Risks from Land Contamination - a Proportionate Approach. Soil Guideline Values: the Way Forward”.

11.3 Scoping and Consultation

11.3.1 Scoping

An ES Scoping Report was issued in March 2010 to key statutory and non-statutory bodies outlining the approach, methodology, baseline conditions and expected effects of the scheme.

It was circulated to all stakeholders, offering them an opportunity to address the proposed methodologies for the EIA or to address issues that have not been adequately covered. A list of consultees is included in chapter 7.3.

A summary of the responses relevant to the Geology and Soils assessment and the respective changes made to the scope of the EIA are summarised in Table 39.

Table 39 **Response of consultees and changes to scope of EIA**

Consultees	Consultees Response	Changes made to scope of EIA
Northern Ireland Environment Agency – Water Management Unit	Reference has been made to the Groundwater Regulations (Northern Ireland) 1998 in the Relevant Legislation and Guidance section of the Geology and Soils chapter of the scoping report for the A8 ES. These Regulations have been replaced by the 2009 Regulations.	The Groundwater Regulations (Northern Ireland) 2009 will be referred to instead of the Groundwater Regulations (Northern Ireland) 1998.
	Any potential for contaminant mobilisation will require a monitoring regime to be implemented.	Comments to be addressed when deriving mitigation measures for any areas of contamination that may be present along the proposed scheme.

11.3.2 Consultation

Additional consultation has been undertaken as part of a series of Environmental Liaison Group meetings. Details of these meetings and issues discussed are covered in chapter 7.2.2 and 7.4.

Consultation with local councils, Northern Ireland Water (NIW) and the Northern Ireland Environment Agency (NIEA) was undertaken to establish baseline data. Further details are presented in chapter 11.6.2.

11.4 Assessment Methodology

11.4.1 Introduction

The assessment methodology of the Geology and Soils chapter is in accordance with DMRB Volume 11, Section 3, Part 11, ‘Geology and Soils’ guidance. This assessment includes:

- Confirmation of information gathered from the relevant statutory bodies and the local planning authorities;
- Review of published geological maps and memoirs;
- Review of previous ground investigation information; and
- Review of supplementary information obtained from the Stage 3 Main Ground Investigation[63], which provides information on ground conditions specific to the proposed scheme.

11.4.2 Scheme Assessment Area

The scheme is not considered to have a significant effect on geology and soils at locations away from the proposed scheme. Therefore the scheme assessment area that has been used for this chapter includes an area extending up to 50m away

[63] Ove Arup and Partners. (2010). A8 Belfast to Larne Dual Carriageway (Coleman's Corner to Ballyrickard Road). Stage 3 Main Ground Investigation Report

from either side of the proposed scheme. This distance is considered to be appropriate for the Geology and Soils chapter on the basis of the A8 Dualling Belfast to Larne Preliminary Sources Study Report[64] and the A8 Belfast to Larne Dual Carriageway (Coleman's Corner to Ballyrickard Road), Preliminary Geotechnical Report[65].

11.4.3 Data Collection and Surveys

The assessment draws on the following published data, site investigations and consultations which has been conducted for an area in and around the site:

- Ove Arup and Partners. (2008). Stage 1 Preliminary Sources Study Report (PSSR);
- Ove Arup and Partners. (2009). Stage 2 Preliminary Geotechnical Report (PGR);
- Ove Arup and Partners. (2010). Stage 3 Main Ground Investigation Report;
- Walk-over survey (undertaken during Stage 2 Assessment);
- A factual report on the Preliminary Ground Investigation prepared in January 2009 by Soil Mechanics Limited (SML)[66];
- A factual Report on the Main Ground Investigation prepared in June 2010 by SML[67];
- GSNI and Belfast. (2004). The Geology of Northern Ireland. Our Natural Foundation. (Mitchell, W.I (ed). Second Edition)[68];
- GSNI (1972) Regional Geology of Northern Ireland;
- Thompson SJ. (1997). Technical Report GSNI/97/6, The Geology of the Country around Antrim, A Description of the Antrim (28) Sheet of Northern Ireland. GSNI;
- Eyles, N. (1983). Glacial Geology. An Introduction for Engineers and Earth Scientists
- GSNI (1994) Larne. Northern Ireland Sheet 21 Solid and Drift. 1: 50 000 (Keyworth, Nottingham: British Geological Survey);
- GSNI (1994) Antrim. Northern Ireland Sheet 28 Solid and Drift. 1: 50 000 (Keyworth, Nottingham: British Geological Survey);
- DOE (1994). Hydrogeological Map of Northern Ireland. 1:250 000;
- DOE (1994). Groundwater Vulnerability Map of Northern Ireland. 1:250 000[69];

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[64] Ove Arup and Partners (May 2008), GN 165: A8 Dualling Belfast to Larne Preliminary Sources Study Report.
[65] Ove Arup and Partners (June 2009), A8 Belfast to Larne Dual Carriageway (Coleman's Corner to Ballyrickard Road). Preliminary Geotechnical Report.
[66] Soil Mechanics (January 2009), A8 Ballynure Bypass Preliminary G.I Report No Y8905, Factual Report on Ground Investigation.
[67] Soil Mechanics (June 2010), A8 Belfast to Larne Dual Carriageway (Coleman's Corner to Ballyrickard Road) Main G.I. Report No Y9911, Factual Report on Ground Investigation.
[68] Soil Mechanics (June 2010), A8 Belfast to Larne Dual Carriageway (Coleman's Corner to Ballyrickard Road) Main G.I. Report No Y9911, Factual Report on Ground Investigation.

- Historical ground investigations;
- Aerial photography;
- Consultations with the NIEA;
- Consultations with the Planning Service, for sources of contaminated land;
- GSNI mines database;
- BS5930:1999. (field operations undertaken by accredited drillers, in compliance with the British Drilling Association's accreditation scheme, and procedures set out);
- British Geological Survey (BGS) Geoindex (BGS website) www.bgs.ac.uk/geoindex/index.htm;
- NIEA. NIEA Designated Sites http://maps.ehsni.gov.uk/NIEAProtectedAreas/Default.aspx;
- Earth Science Conservation Review (ESCR). Geological Sites in Northern Ireland http://www.habitas.org.uk/escr/index.html;
- OS (1832) NI Antrim Sheets 40, 45, 46 and 51 1st Edition 1:10560;
- OS (1857) NI Antrim Sheets 40, 45, 46 and 51 1st Revision 1:10560;
- OS (1902-03) NI Antrim Sheets 40, 45, 46 and 51 2nd Revision 1:10560;
- OS (1933) NI Antrim Sheets 40, 45, 46 and 51 3rd Revision 1:10560;
- OS (1965) Irish Grid Sheets 70 / 14, 70 / 15 1:2500;
- OS (1965-66) Irish Grid Sheets 82 / 12, 82 / 16 1:2500;
- OS (1966) Irish Grid Sheets 83 / 1, 83 / 2, 83 / 5, 83 / 6, 83 / 9, 83 / 13 1:2500; and
- OS (1961-63) Irish Grid Sheets 97, 1: 10560.

11.4.4 Methodology for Establishing Baseline Conditions

The presence and nature of potential areas of contamination and existing exposures has been researched through desk-based study utilising the resources identified in chapter 11.4.3, comprehensive site walkovers, and where appropriate, intrusive ground investigation. All previous studies and investigations have been reviewed in the context of the proposed new carriageway for the scheme and up to 50m either side of the proposed new carriageway as described in chapter 11.4.2.

The geological baseline conditions have been established from published geological maps and memoirs and from ground investigation information.

Environmental information relating to pollution incidents, landfill sites including historic potential sources of contamination have been received from the NIEA and local authorities.

A full site walkover was also undertaken to clarify the baseline conditions and to identify any areas that may have not been identified through the desk based study.

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[69] Department of the Environment for Northern Ireland (1994). Groundwater Vulnerability Map of Northern Ireland. 1:250 000.

The desk studies, investigations and consultations together with recent work undertaken are summarised in Table 40.

Where possible, the baseline conditions have been assessed using the most up to date information e.g. the Stage 3 Main Ground Investigation Report. However, older sources of information have been reviewed in order to produce a comprehensive review of the baseline conditions.

Table 40 **Summary of Environmental Assessment Progress**

Consultees / Information Sources	Work to Date	Recent Work Undertaken
GSNI Newtownabbey Borough Environmental Health Department Larne Borough Environmental Health Department NIEA – Water Management Unit NIEA – Landfill and Waste	Previous investigations associated with the existing A8 for the crawler lanes north and south of Ballynure and the Coleman's Corner Roundabout Stage 1 Preliminary Sources Study Report Stage 2 Preliminary Ground Investigation Stage 2 Preliminary Geotechnical Report Stage 3 Main Ground Investigation Stage 3 Main Ground Investigation Report	Reviewed and updated existing assessments of effects. Stage 3 Supplementary Ground Investigation

11.4.4.1 Methodology for Assessment of Geology and Geomorphology

The location of any special sites, as designated under the Environment (Northern Ireland) Order 2002, including ASSIs, relating to the geology, geomorphology and agricultural land quality have been identified by studying thematic maps provided by the NIEA[16], information provided on the Earth Science Conservation Review (ESCR) website[17] and consultations with the GSNI.

All areas of cutting that have the opportunity to expose bedrock were identified with the use of exploratory hole information. The indicative depth of superficial cover allowed the potential thickness of exposed bedrock to be determined.

Volume 11 Section 3 Part 11 of DMRB refers to potential impacts on agricultural quality of soils with reference to the use of Agricultural Land Classification maps. Assessment of potential impacts on agricultural quality of soils is provided in the Community and Private Assets section of this assessment; refer to chapter 16 for details.

11.4.4.2 Methodology for Assessment of Soil Contamination

All areas of made ground that had previously been identified during the course of the fieldwork were sampled. Contamination testing was carried out on all samples of made ground that were associated with potentially contaminative activities and samples were tested for a range of contaminants (see chapter 11.6.3.7).

The soil chemical results pertaining to the A8 have been compared with the Environment Agency's (UK) CLEA Commercial / Industrial screening guideline values in order to assess the level of contamination at the site, and subsequently identify any Contaminants of Concern (CoC) and/or the need for remediation with respect to human health. A summary of contamination results are presented in **Appendix F, ES Volume II**.

For assessment of soil contamination, the DOE refer to a 2006 publication by the Defra (UK) facilitated SGV Task Force. This guidance provides comment on changes to the guidance for the assessment of contaminated land. Subsequent to this report Defra and the EA withdrew the then current guidance detailed in the EA publications CLR9 and CLR10, and the current SGVs, and produced a revised and updated framework for the assessment of contaminated land in the Environment Agency (UK) documents SC050021/SR2 and SC050021/SR3. Revised and new SGVs were published in March 2009 and these SGVs, where available, have been used for the contamination assessment. Where SGVs or toxicology reports for certain determinants are not available those detailed in the Land Quality Management Generic Assessment Criteria LQM GAC (2nd Edition) publication and/or Arup in-house GACs have been applied.

The commercial end use soil screening values are generic values and not site specific for a highway, however applying these values is considered to be a conservative approach.

The chemical results are discussed and assessed in 11.6.3 and 11.8.

Japanese Knotweed has been identified along the route. Assessment of potential impacts presented by the presence of Japanese Knotweed is provided in the chapter 8 ‘Nature Conservation’.

11.4.5 Methodology for Assessment of Effects due to Construction

The assessment of the impacts and effects on the underlying ground conditions of construction of the A8 Dualling scheme has been carried out on the basis of the extent, method and programme of the proposed earthworks and construction activities that would be required.

This chapter considers the effects on geology and soils only. Potential contaminative effects on groundwater are discussed in chapter 12 ‘Road Drainage and the Water Environment’.

11.4.5.1 Geology and Geomorphology

The methodology for assessing the effects from construction and impacts on geology and geomorphology has been undertaken in accordance with the procedure outlined below under the heading ‘Assessment Principles’ and the guidelines given in Volume 11 of DMRB (Section 3 Part 11, Geology and Soils). On this basis, the following steps were followed:

- Step 1: assess the importance / value of any geological or geomorphological feature using the criteria;
- Step 2: assess the magnitude of the effect of construction on the geological or geomorphological feature using the criteria; and

- Step 3: combine the importance and the magnitude of the effect of construction on the geological or geomorphological feature using the relevant matrix to establish the overall significance of the effect.

11.4.5.2 Soil Contamination

The methodology for assessing the contamination effects from construction on the ground has been undertaken in accordance with the procedure outlined below and the guidelines provided in Volume 11 of DMRB (Section 3 Part 11, Geology and Soils). This is in accordance with current UK legislation on contaminated land which is contained in Part IIA of the Environmental Protection Act, 1990. On this basis, the following steps were followed:

- Step 1: assess the importance / value of any identified receptor using the criteria;
- Step 2: assess the magnitude of the effect of construction on the receptor using the criteria; and
- Step 3: combine the importance and the magnitude of the effect of construction on the receptor using the relevant matrix to establish the overall significance of the effect.

11.4.6 Methodology for Assessment of Effects from Operation

The assessment of the effects and impacts on the underlying ground conditions of construction of the A8 Dualling scheme has considered its operational characteristics.

This chapter considers the effects on geology and soils only. Potential contaminative effects on groundwater are discussed in chapter 12 ‘Road Drainage and the Water Environment’.

11.4.6.1 Geology and Geomorphology

The methodology for assessment of effects from operation on geology and geomorphology is in line with the methodology used for construction effects. However, no impacts or effects relating to the geological or geomorphological features have been identified from operation of the A8 dual carriageway.

11.4.6.2 Soil Contamination

The methodology for assessment of effects from operation on contamination to the ground is in line with the methodology used for construction effects in Section 11.4.5.2.

11.4.7 Significance Criteria

DMRB significance criteria, presented in chapter 6 ‘Approach and Methods’, have been adopted for this assessment and are based on:

- The reduction of geological/geomorphological interest within any identified geological ASSI, SLNCI, and SAC; and

- The presence of contaminants in soils which may result in harm to the environment and human health and/or pollution of controlled waters. The assessment to identify any significant impact on groundwater is presented in chapter 12 'Road Drainage and the Water Environment'.

The importance of any geological/geomorphological attributes or features identified or the creation of any such geological features worthy of assessment have been assessed in accordance with the scale detailed within Table 41.

Table 41 **Environmental Value of Feature**

Value	Criteria Descriptors
Very high	Including internationally designated sites;
High	Including nationally designated sites;
Medium	Including regionally important sites;
Low	Including sites which are not designated, but which have a local interest;
Negligible	Including sites with little or no interest.

The magnitude of impact upon identified features has been based on the following scale detailed within Table 42.

Table 42 **Magnitude of Impact**

Magnitude	Criteria Descriptors
Major	Where the effect results in a loss of a feature or attribute;
Moderate	Where there is a partial loss of a feature or attribute;
Minor	Resulting in a minor effect on a feature or attribute;
Negligible	Where the effect is of insufficient magnitude to affect integrity;
Positive	Where a new feature is created.

The overall significance of effects has been determined by a combination of magnitude and value/importance as outlined under DMRB Guidance Volume 11, Section 3, Part 2, HA 208/07; described in chapter 6 of this report.

11.5 Limitations and Assumptions

11.5.1 Limitations

All contamination testing carried out to date has been targeted at locations identified through desk study, site walkovers or ground investigation fieldwork as having the potential to contain contaminated material.

There remains a residual risk that additional areas of the scheme assessment area may contain contamination that has not been identified to date, and these areas may remain unidentified prior to construction.

The existing road was not specifically targeted for potentially contaminative material; however a small number of contamination tests were carried out on samples of the construction materials of the existing road.

11.5.2 Assumptions

The scheme is not considered to have a significant effect on geology and soils at locations further than 50m away from the proposed new carriageway. Therefore, environmental assessment of geology and soils has not been undertaken outside this area.

Measures would be put in place during the construction of the proposed scheme to control potential pollution incidents caused by accidental leaks and spills of fuels and oils stored and used on site for construction plant and machinery. Therefore, it has been assumed in the construction assessment that the management measures and the construction strategy are adopted and are effective.

During the import of material to the site for the construction of the scheme, it is assumed that appropriate control measures will be taken to ensure that imported material presents no contamination risk to potential receptors.

11.6 Baseline Conditions

11.6.1 Landscape and Topography

The Geology and Soils assessment area is situated between Newtownabbey to the south and Larne to the north. It is typically rural with minor dwellings and agricultural fields; however the proposed scheme skirts west of the existing route of the A8 and the town of Ballynure.

The proposed scheme traverses the broad, gently undulating open valley of the Six Mile Water. This valley follows a major fault line (Six Mile Water Fault), and at its north eastern end stream courses flow towards Larne in the north east, whilst near the central part of the route the Six Mile Water watercourse flows westwards into Lough Neagh.

The landscape has been much affected by the last glacial period when the whole area was covered by an ice sheet. The sub-glacial environment scoured the landscape, leaving a thin discontinuous covering of glacial deposits. Streamlining of obstructions formed drumlin mounds which are most abundant towards Larne. Their long axes are oriented in a north easterly direction reflecting a flow of ice in that direction.

The topography left by the glaciers, has only been slightly modified by post glacial erosion, and many of the stream and river courses show an ‘immature’ chaotic pattern, with irregular valley profiles.

The elevation of the A8 is approximately 140m Above Ordnance Datum (AOD) at Coleman’s Corner falling to about 105m AOD at Ballynure. North east of Ballynure it is approximately 130m AOD, falling to 90m AOD towards Larne.

There are no sites of geological importance (ASSIs, SACs etc) within the Geology and Soils assessment area. However, there are a number of archaeological sites which create ground features. These sites are considered within the ‘Cultural Heritage’ chapter of this ES (See chapter 10).

11.6.2 Consultation with Statutory Bodies and Agencies

The Environmental Health departments of Newtownabbey and Larne Borough Councils and NIEA were contacted for land filling and/or waste disposal records during the preparation of the PSSR. Newtownabbey Borough Council covers the southern part of the scheme assessment area whilst Larne Borough Council covers the northern part of the scheme assessment area. The responses are summarised in Table 43.

Table 43 **Consultation Responses Regarding Contaminated Land.**

Organisation	Response
Newtownabbey Borough Council	Confirmation that the landfill near Bruslee is now closed, although the recycling facility and civic amenity site is operational.
Larne Borough Council	No response
Northern Ireland Environment Agency – Water Management Unit	Information regarding pollution incidents within the scheme assessment area including location (with grid references), category of contaminant and severity of incident.
Northern Ireland Environment Agency – Landfill and Waste	Information regarding pollution incidents within the scheme assessment area including location (with grid references), category of contaminant and severity of incident.

11.6.3 Review of Ground Investigations

Historic ground investigations and ground investigations carried out during the scheme have been reviewed and are presented in the following sections.

A preliminary ground investigation was carried out in October 2008[4] and a main ground investigation carried out between October 2009 and May 2010[5]. In total these investigations comprised:

- 151 No. machine dug trial pits excavated to a maximum depth of 4.6m bgl;
- 7 No. hand dug inspection pits to a maximum depth of 1.2m;
- 36 No. cable percussive boreholes with rotary cored follow-on in 23 No. of these boreholes to a maximum depth of 25m bgl; and
- 5 No. rotary boreholes to a maximum depth of 20.0m bgl.

In-situ testing comprised:

- Undrained shear strength by hand vane;
- Standard Penetration Tests (SPTs);
- Californian Bearing Ratio (CBR) tests; and
- Permeability tests within installations following completion of the field work.

In areas of potential contamination tests carried out included:

Soil Chemical Tests

Laboratory chemical testing included:

- Arsenic, cadmium, chromium, hexavalent chromium, lead, mercury, selenium, boron (water soluble sulphide), copper, nickel, zinc, polycyclic aromatic hydrocarbons (PAH) Environmental Protection Agency (EPA) 16 speciated, phenol (total monohydric), total and free cyanide, thiocyanate, total sulphate, sulphide, elemental sulphur, pH, Total Petroleum Hydrocarbons (TPH) C10 to C40, Semi-Volatile Organic Compounds (SVOCs), Volatile Organic Compounds (VOCs) and an asbestos screen.

Geotechnical Tests

Laboratory geotechnical testing included:

- Natural moisture content determination;
- Atterberg limit determination;
- Particle Size Distribution (PSD) analysis;
- pH and water soluble sulphate content on soils and waters;
- Acid soluble sulphur, total reduced sulphur and total sulphur;
- Organic matter content tests;
- Unconsolidated undrained triaxial compression tests;
- Consolidated undrained triaxial tests with measurement of pore water pressure;
- Consolidated drained small shear box tests;
- One dimensional oedometer consolidation tests, including measurement of coefficient of secondary compression;
- Dry density / moisture content relationship by heavy compaction;
- Californian bearing ratio / moisture content relationship;
- Moisture condition value / moisture content relationship;
- Uniaxial compressive strength tests;
- Point load index tests; and
- LA Abrasion coefficient tests.

Groundwater was sampled and tested. The results are presented in chapter 12.

Ground Conditions

The baseline ground conditions within the scheme assessment area have been determined following review of available published geological maps and memoirs, and ground investigation information available.

The ground conditions present within the proposed scheme are summarised in Table 44.

Table 44 **Ground Conditions Summary**

Material	Thickness (m)
Topsoil	Absent to 0.6
Made Ground	Absent to 1.85
Alluvium	Absent to 1.8
Peat	Absent to 1.7
Weathered Glacial Till	Absent to 2.8
Glacial Till	Absent to 7.0
Fluvio-Glacial Deposits	Absent to 3.9
Basalt Bedrock (Upper and Lower Basalt Formation)	Maximum proven thickness of 17.0

11.6.3.1 Made Ground

The land use within the Geology and Soils assessment area is predominantly agricultural land; the effects on agricultural soils are detailed within chapter 16.5.2.5 of this ES ‘Community and Private Assets’. However made ground was found at a few discrete locations in relation to specific historical land uses. The locations and thicknesses of made ground are summarised in Table 45 and illustrated on **Drawing A8-S3-3300 Appendix F, ES Volume II**.

A review of previous ground investigations revealed most of the areas of made ground are generally associated with locations where the ground has been raised or dressed either to provide access to fields or for car parking. However, some areas of made ground comprise reworked superficial deposits and imported material associated with the development of the existing road, historical railway and historical railway station. In addition, some areas of made ground comprise reworked superficial deposits and waste materials associated with a Roads Service Depot. The exploratory holes commissioned by the Roads Service for the Coleman’s Corner Roundabout and crawler lanes north and south of Ballynure generally encountered made ground associated with the existing road.

Made ground encountered in TP049, TP048, TP047, TP045, BH43T, BH42T, BH41T and TP038 was typically described as a firm to stiff friable sandy clay, with basalt gravel. It mainly comprised reworked glacial till, but often included old road material such as tarmac and aggregate indicating that some of the material is possibly rubble from historic road construction, or hardstanding that has been incorporated into ground adjacent to the existing road. It was typically 0.5m to 1.0m thick and had a maximum thickness of 2.8m. In BH43T, BH42T and TP049 made ground was described as compact hardcore, Type 1 aggregate and tarmac. For BH42T and BH43T this may be indicative of the construction of the A8 road, which lies immediately adjacent to these locations. The made ground encountered within TP049 appears to comprise arisings from a former area of hardstanding or road surface that have been incorporated into natural deposits.

The preliminary[65] and main ground investigations[70] mainly targeted areas of historical land use that have the potential to contain contaminative material,

[70] Ove Arup and Partners. (2010). Stage 3 Main Ground Investigation Report

including the Roads Service Depot, former railway station and associated railway lines.

TP211 to TP213 identified significant thicknesses of made ground beneath and adjacent to the proposed scheme at the Roads Service Depot. This area of made ground was extremely variable and typically described as a firm brown sandy slightly gravelly clay and brown slightly clayey very gravelly sand with fragments of concrete, steel strapping, fragments of paint and kerbs. The made ground was also encountered as a reworked glacial till, described as soft to firm, slightly gravelly, sandy, clayey silt. The thickness of made ground varied between 1.1m and 3.1m.

The onsite observations at TP213, which is located in a former depot area, have indicated that there was suspected hydrocarbon contamination at a depth of between 1.35 and 1.80m bgl. This was based on visual and olfactory observations. The results indicate low levels of high carbon chain length petroleum hydrocarbons and polycylic aromatic hydrocarbons, which are of low volatility. No detectable levels of volatile organic compounds were detected. However it is not possible to confirm whether this result is representative of the soils, as there was a significant length of time between the sampling of the subsurface and the analysis being undertaken. This may have impacted on the reliability of the results as significant degradation of the sample may have occurred.

The above is also true for test results received for phenols, VOCs, SVOCs, PAHs and TPHs for the following samples: BH105, BH118, BH125, TP127, TP212, TP213 and HDTP101 to 106.

TP25 and TP32 were targeted at the former railway line that crosses the proposed route. Made ground was typically 0.9 to 1.3m thick and was described as a firm brown, slightly sandy, gravelly silt, with basalt gravel. It mainly comprised reworked glacial till with some railway ash.

TP127, TP181, TP182 and HDP101 to HDP106 were targeted at the former railway station and associated embankment at Ch 10+500 to Ch 10+560. Made ground was typically 1.0 to 1.3m thick with a maximum thickness of 1.6m. It was described as a soft to firm brown slightly sandy, slightly gravelly, slightly organic clay with cobbles of various lithologies. Plastic bags, brick and concrete fragments were also encountered in TP127 and TP181, which are likely to be remnants of fly tipping or another associated activity.

BH118, TP170, TP172, BH105 and BH108 of the main ground investigation targeted areas of the existing A8 and adjacent roads to investigate the historic road construction, underlying fill and embankment / verge material that was used in construction of the original A8 and the subsequent upgrade in the late 1950s.

Made ground underlying the existing A8 was typically 0.25m to 0.5m thick and was described as firm brown, slightly gravelly, sandy clay with cobble and boulders of various lithologies. A thin layer of macadam and concrete was also encountered in TP170.

Embankment / verge material was typically described as firm brown slightly sandy slightly gravelly clay with cobbles and boulders of basalt. The thickness of embankment material was variable between 0.55 and 1.7m.

With the exception of the macadam and concrete encountered in TP170, the made ground making up the underlying fill and embankment material typically comprised reworked glacial till. Therefore this material does not present a significant potential for contamination. Contamination results are discussed further in chapter 11.6.3.7.

BH125, TP207, TP184 and TP185 were targeted at areas of made ground associated with previous agricultural activity. These areas of made ground are generally associated with historic ground raising and the provision of access to agricultural land. Made ground between 0.55m and 1.7m in thickness was identified and described as slightly sandy slightly gravelly silty clay. A farm access road targeted by TP207 revealed a 0.35m thickness of road base stone underlying a bitmac road cover.

Table 45 **Summary of Locations and Origins of Made Ground**

Exploratory Hole	**Chainage/ location**	**Maximum Thickness (m)**	**Description and origin (where known)**
TP038	Ch 0+040	0.6	Topsoil intermixed with tarmac and Type 1 aggregate (0.25m thick) over firm to stiff sandy gravelly CLAY with occasional tarmac and Type 1 aggregate *Possible rubble from historic road construction at side of verge of existing road.*
TP127	Ch 3+550	1.5	Firm becoming stiff black dark brown slightly sandy slightly gravelly CLAY with medium cobble content, plastic bags, steel bands, steel frames, rootlets and fragments of concrete up to 300mm. *Made ground comprising reworked natural deposits and waste products associated with historic ground raising in area of boggy ground.*
BH41T	Ch 3+860	1.2	Firm to stiff (friable) brown sandy gravelly CLAY with basalt cobbles *Possible reworked natural deposits associated with verge of existing road.*
BH42T	Ch 3+980	>1.1	Sandy gravelly CLAY and hardcore, occasional boulders *Hardstanding associated with verge of existing road.*
BH43T	Ch 4+100	>2.8	Compact hardcore, reddish brown sandy CLAY and occasional boulder *Hardstanding associated with verge of existing road.*
TP045	Ch 4+330 (offset from mainline)	0.45	Sandy TOPSOIL intermixed with broken basalt rock *Possible reworked natural deposits associated with verge of existing road.*
TP047	Ch 4+520 (offset from mainline)	0.6	Intermixed firm brown very sandy gravelly CLAY with occasional cobbles and type one aggregate *Possible reworked natural deposits associated with verge of existing road.*

Exploratory Hole	**Chainage/ location**	**Maximum Thickness (m)**	**Description and origin (where known)**
TP048	Ch 4+610 (offset from mainline)	0.8	Intermixed firm to stiff (friable) brown sandy gravelly CLAY with angular basalt cobbles, Type 1 aggregate and occasional tarmac *Possible reworked natural deposits associated with verge of existing road.*
TP049	Ch 4+700 (offset from mainline)	1.1	Intermixed firm to stiff (friable) brown sandy gravelly CLAY with angular basalt, cobbles, Type 1 aggregate and tarmac *Arisings from historic road or hardstanding, intermixed with natural deposits, possibly glacial till.*
BH105A	Ch 4+830	0.4	Medium dense brown very sandy subangular to subrounded fine to coarse GRAVEL of various lithologies. Sand is fine to coarse. *Associated with earthworks adjacent to existing Templepatrick Road.*
BH105	Ch 4+830	0.6	Brown slightly very sandy fine to coarse subangular to subrounded GRAVEL of various lithologies. *Associated with earthworks adjacent to existing Templepatrick Road.*
BH108	Ch 5+530	0.4 (stratum 1)	Macadam
		0.5 (stratum 2)	Dense greyish brown silty sandy subangular to subrounded fine to coarse GRAVEL of various lithologies.
		0.4 (stratum 3)	Medium dense greyish brown silty very sandy subangular to subrounded fine to coarse GRAVEL of various lithologies. *Existing road construction at Church Road.*
TP170	Ch 9+520	0.1 (stratum 1)	Macadam
		0.1 (stratum 2)	Concrete
		0.55 (stratum 3)	Brown, slightly clayey, sandy, subangular to subrounded, fine to coarse grained GRAVEL of various lithologies *Associated with historic A8 alignment.*
TP172	Ch 9+870	0.25	Grey slightly clayey sandy subangular to angular fine to coarse GRAVEL of various lithologies. *Associated with historic A8 alignment.*
BH118	Ch 10+060	2.6	Stiff brown clayey sandy subangular to surbrounded fine to coarse GRAVEL of various lithologies. *Associated with verge of existing A8 alignment.*
HDP106	Ch 10+490	>1.0	Firm orange brown slightly sandy slightly gravelly CLAY with medium cobble and boulder content *Former railway station*
HDP105	Ch 10+505	0.7 (stratum 1)	Firm brown slightly sandy slightly gravelly CLAY with low cobble content and roots. Sand is fine to coarse.

Exploratory Hole	Chainage/ location	Maximum Thickness (m)	Description and origin (where known)
			Former railway embankment
		>1.2 (stratum 2)	Firm orange brown slightly sandy slightly gravelly CLAY with low cobble content. *Former railway embankment*
HDP104	Ch 10+515	0.4 (stratum 1)	Soft brown slightly sandy slightly gravelly slightly organic CLAY
		>0.5 (stratum 2)	Firm brown slightly sandy slightly gravelly CLAY with medium cobble and boulder content. *Former railway station*
HDP 102	Ch 10+520	>1	Soft to firm brown slightly sandy slightly gravelly slightly organic CLAY with low cobble content. *Former railway station*
TP181	Ch 10+530	1.3	Firm brown slightly sandy slightly gravelly CLAY with low cobble content, some plastic bags and brick fragments. *Former railway embankment*
HDP101	Ch 10+530	0.5 (stratum 1)	Firm brown slightly sandy slightly gravelly CLAY.
		>0.4 (stratum 2)	Firm orange brown slightly sandy slightly gravelly CLAY with low cobble content. *Former railway embankment*
HDP103	Ch 10+530	0.5	Firm brown slightly sandy slightly gravelly CLAY with low cobble and rootlets and concrete fragments.
		>0.4	Firm orange slightly sandy slightly gravelly CLAY with low cobble content. *Former railway embankment*
TP182	Ch 10+550	1.6 (incl.topsoil 700mm thick)	Soft brown slightly sandy slightly clayey PEAT. Sand is fine to medium. *Former railway embankment*
TP25	Ch 10+780 (offset from mainline)	1.3	Firm brown slightly sandy gravelly Silt. Sand is fine to coarse. *Made ground possibly associated with historic area of former railway line.*
TP184	Ch 11+030 (offset from mainline)	1.3	Firm brown slightly sandy slightly gravelly becoming gravelly slightly clayey SILT with high cobble and boulder content. *Possible reworked natural deposits in area of ongoing agricultural activity.*
TP185	Ch 11+230	>0.55	Firm brown slightly sandy slightly gravelly CLAY with some cobble and boulder content. *Made ground comprising reworked natural deposits and rubble of concrete, possibly associated with historic levelling of ground adjacent to existing A8*

Exploratory Hole	Chainage/ location	Maximum Thickness (m)	Description and origin (where known)
TP203	Ch 13+000	0.35	Firm orange brown slightly sandy slightly gravelly CLAY with medium cobble content, concrete fragments and some pieces of timber. *Associated with verge of existing A8 alignment*
TP32	Ch 13+580 (offset from mainline)	0.9	Brown slightly sandy gravelly SILT with pieces of white limestone. *Made ground possibly associated with historic area of former railway line.*
TP207	Ch 13+630	0.15 (stratum 1)	Bitmac
		0.35 (stratum 2)	Road base stone *Associated with access to field off existing A8 alignment.*
TP212	Ch 14+090	1.4	Brown clayey very silty very gravelly fine to coarse SAND with medium cobble and boulder content, fragments of concrete, steel strapping and fragments of paint.
		>1.1	Firm brown slightly sandy gravelly slightly silty CLAY with high cobble and boulder content and some concrete fragments. *Roads Service depot*
TP211	Ch 14+090	>1.1	Firm brown slightly sandy gravelly slightly clayey SILT with concrete blocks, kerbs, metal bracing, and fragments of concrete and high cobble content. *Roads Service Depot*
TP213	Ch 14+120	1.35 (stratum 1)	Hardcore in a matrix of grey, very silty, fine to coarse grained sand.
		0.45 (stratum 2)	Soft to firm, grey, slightly gravelly, sandy, clayey SILT. Very strong odour.
		0.5 (stratum 3)	Soft to firm, grey, slightly gravelly, sandy, clayey SILT.
		0.8 (stratum 4)	Firm, brown, slightly sandy, silty CLAY. *Roads Service Depot*
BH125	Ch 14+290	2.5 (stratum 1)	Greyish brown, silty, sandy, subangular, fine to coarse grained basalt GRAVEL.
		1.9 (stratum 2)	Firm, becoming firm to stiff, brownish grey, slightly sandy, gravelly, slightly clayey organic SILT with high cobble and boulder content. *Associated with farm track leading to existing underpass.*

11.6.3.2 Peat

Peat was occasionally encountered at localised positions along the proposed route. Peat was typically encountered within the poorly drained valley bottoms and topographic hollows generally overlying or stratified with alluvium.

Exploratory holes that encountered peat and the interpreted extent of peat throughout the route is illustrated on **Drawing A8-S3-3300 Appendix F, ES Volume II** and is summarised below in Table 46.

Table 46 **Summary of the Locations of Peat**

Exploratory Hole	**Chainage**	**Max Depth to Base of Peat(m)**	**Max Thickness (m)**	**Description**
TP8	Ch 3+020	0.9	0.4	Spongy amorphous, slightly clayey, silty PEAT.
TP18	Ch 6+620 (approx. 200m offset)	0.3	0.3	Firm, fibrous, slightly silty, slightly sandy PEAT.
BH117	Ch 9+390	1.7	1.4	Very soft, black, pseudo-fibrous PEAT.
BH117A	Ch 9+390	1.7	1.5	Very soft, black, pseudo-fibrous PEAT.
TP171	Ch 9+730	0.7	0.7	Soft, dark, brown, silty, amorphous PEAT.
BH122	Ch 12+570	1.7	0.35	Very soft, dark brown, clayey, fibrous PEAT.
TP30	Ch 12+940	1.2	0.9	Firm, amorphous, slightly clayey PEAT.
TP204	Ch 13+150	3	2.8	Soft, black, fibrous, pseudo-fibrous in places PEAT.
TP31	Ch 13+170	1.9	1.7	Firm, pseudo-fibrous, dark brown, slightly clayey PEAT with fibres.
TP205	Ch 13+360	1.4	0.4	Very soft, dark brown, silty, amorphous PEAT.

11.6.3.3 Alluvium

Alluvium was often identified in combination with peat and was encountered within poorly drained areas including adjacent to the Larne / Inver River and the Ballynure Water. Alluvium is generally a thin, typically up to 1.0m, although thicknesses of up to 2.5m have been identified, firm to stiff, sandy, very gravelly, sometimes organic clay.

11.6.3.4 Fluvio-Glacial Deposits

Fluvio-glacial deposits were encountered below the alluvium and peat, occasionally occurring in combination with glacial till. Fluvio-glacial ice-contact deposits formed as outwash from the retreating glacier and reworked glacial material leaving a sand and gravel deposit with variable amounts of fines.

Fluvio-glacial deposits are typically described as a silty sandy gravel and commonly places overlie the glacial till where present, but can also be found interbedded with glacial till deposits.

11.6.3.5 Glacial Till

Glacial till is present from the ground surface across a large proportion of the valley sides that are traversed by the A8. Towards the northern end of the scheme, the glacial till typically forms the characteristic drumlin topography.

Glacial till predominantly comprises lodgement till deposited in a sub-glacial environment, and typically described as a firm silty sandy gravelly clay / silt.

Thicknesses of glacial till vary significantly along the proposed route, from being absent or present in small thicknesses where the road skirts along the valley floor at lower elevations, to thicknesses of up to 16.9m in exploratory hole BH110 at Ch 6+100m.

11.6.3.6 Basalt Bedrock

The solid geology of the proposed scheme is predominantly Palaeocene basalt of the Lower and Upper Basalt Formations which are separated by the Inter-basaltic Bed. The Inter-basaltic Bed formed during a pause in lava eruptions which resulted in the weathering of the upper surface of the Lower Basalt Formation. The Inter-basaltic Bed is iron rich and forms a workable iron ore at various locations across Antrim.

The Lower and Upper Basalt Formations are variable within individual lava flows. The central parts are typically very strong and jointing is widely spaced, whereas the tops and bases of the flows are much weaker.

Basalt bedrock is covered by superficial deposits along the majority of the proposed route. Rockhead is typically present from around 5m bgl, however in some locations it is present from the ground surface and locally superficial deposits can reach depths of up to approximately 18m.

The construction of the proposed scheme will involve the excavation of significant thicknesses of basaltic bedrock. The locations and anticipated thicknesses of those cuttings that are likely to expose bedrock are summarised in Table 47 below and are illustrated on **Drawing A8-S3-3300 Appendix F, ES Volume II**.

Table 47 **Summary of the Locations of Cuttings and the Thickness of Exposed Bedrock**

Chainage	Maximum Depth of Cutting (m)	Anticipated Thickness of Exposed Bedrock (m)
Ch 4+450 to Ch 4+850	10	Up to 7m
Ch 6+280 to Ch 7+650	12	Up to 10m (typically 5 m)

11.6.3.7 Contamination Testing

A review of previous ground investigations[1,3] and the desk study information from the PSSR[2] revealed little evidence of contamination along the route and concluded that there is a low risk of contamination as a result of historic and / or current land uses.

From review of the exploratory logs from the preliminary and main ground investigation and previous ground investigations[5,6], 33 No. locations of made ground / possible made ground were encountered within the Geology and Soils assessment area (see **Drawing A8-S3-3300 Appendix F, ES Volume II** for details). These areas of made ground are discussed further in chapter 11.6.3.1. Some areas of made ground, which were identified during the PSSR, were not considered during this assessment due to their locations outside of the Geology and Soils assessment area.

Samples have been taken in areas that have been subject to intrusive ground investigation. 31 No. soil samples taken from exploratory holes at locations of made ground were analysed for a suite of contaminants. The areas that were sampled included those that posed a significant potential for contamination. These locations included areas where made ground comprised artificial material such as ash, concrete, plastic bags and bricks (e.g. the former railway station and the Roads Service Depot). The contaminants tested were selected by an Arup engineer on the basis of the history of the location from which they were sampled and the nature of the material encountered.

During the preliminary ground investigation the contamination assessment was only considered within the former railway made ground. Samples from TP25 and TP32 were submitted for chemical testing and the determinands were mainly at background levels, however the determinands for chromium and nickel were slightly elevated, suggesting that the railway made ground contains some ash.

Other locations included areas where made ground comprised artificial material such as ash, concrete, plastic bags and bricks (e.g. the former railway station and the Roads Service Depot).

Some samples of made ground which were interpreted to be reworked glacial material were taken to identify the chemical characteristics of this material. However, as this material is reworked natural ground, it was interpreted as relatively inert and uncontaminated, and samples were not taken at every location.

A summary of the results of contamination testing is detailed below in Table 48. A summary of the soil and water chemical test results, are presented within **Appendix F, ES Volume II**.

Table 48 **Summary Table of Contamination Testing**

Exploratory Hole	**Chainage**	**Sample depths (m)**	**Geological Description (*and Origin*)**	**Summary of Results**
TP127	Ch 3+550	0.5, 1.0, 1.5	1.3m of made ground described as slightly sandy slightly gravelly clay containing plastic bags, steel bands, steel frames and fragments of concrete and a high cobble content of basaltic lithology (*associated with historic ground raising in area of boggy ground*).	All contaminant concentrations were below the limits of detection or below the commercial guideline values.
BH105	Ch 4+835	0.3	0.6m of possibly reworked made ground described as slightly silty very sandy	All contaminant concentrations were below the limits of

Exploratory Hole	Chainage	Sample depths (m)	Geological Description (*and Origin*)	Summary of Results
			gravel (*associated with earthworks adjacent to existing Templepatrick Road*).	detection or below the commercial guideline values.
TP170	Ch 9+520	0.5	Thin layer of macadam and concrete overlying 0.55m of slightly clayey sandy gravel with various lithologies (*associated with historic A8 alignment*).	All contaminant concentrations were below the limits of detection or below the commercial guideline values.
TP172	Ch 9+870	0.1	0.25m of made ground described as slightly clayey sandy gravel of various lithologies (*associated with historic A8 alignment*).	All contaminant concentrations were below the limits of detection or below the commercial guideline values.
BH118	Ch 10+060	0.5	0.4m of topsoil overlying 2.6m of possibly reworked natural ground described as clayey sandy gravel (*associated with construction of existing road*).	All contaminant concentrations were below the limits of detection or below the commercial guideline values.
HDP106	Ch 10+490	0.1, 0.6	0.3m of topsoil overlying 0.7m of possibly reworked natural ground described as slightly sandy slightly gravelly clay with medium cobble and boulder content (*reworked natural material associated with regrading of former railway station*).	All contaminant concentrations were below the limits of detection or below the commercial guideline values. A concentration of 937mg/kg was detected for acid soluble sulphate which is elevated in relation to the protection of sub surface concrete; see BRE Special Digest 1 [23].
HDP105	Ch 10+505	1.2	0.2m of topsoil overlying 1.0m of possibly reworked natural ground described as slightly sandy slightly gravelly clay with low cobble and boulder content (*reworked natural material associated with regrading of former railway station*).	All contaminant concentrations were below the limits of detection or below the commercial guideline values.
HDP104	Ch 10+515	0.6	0.3m of topsoil overlying 0.9m of possibly reworked natural ground described as slightly sandy slightly gravelly slightly organic clay with medium cobble and boulder content (*reworked natural material*	All contaminant concentrations were below the limits of detection or below the commercial guideline values. A concentration of

Exploratory Hole	Chainage	Sample depths (m)	Geological Description (*and Origin*)	Summary of Results
			associated with regrading of former railway station).	987mg/kg was detected for acid soluble sulphate which is elevated in relation to the protection of sub surface concrete [23].
HDP102	Ch 10+520	1.2	0.2m of topsoil overlying 1.0m of possibly reworked natural ground described as slightly sandy slightly gravelly organic clay (*reworked natural material associated with regrading of former railway station*).	All contaminant concentrations were below the limits of detection or below the commercial guideline values.
HDP101	Ch 10+530	0.6	0.3m of topsoil overlying 0.9m of possibly reworked natural ground described as slightly sandy slightly gravelly clay with low cobble content (*reworked natural material associated with regrading of former railway station*).	All contaminant concentrations were below the limits of detection or below the commercial guideline values.
TP181	Ch 10+530	0.5, 1.4	1.3m of made ground described as slightly sandy slightly gravelly clay with cobbles, plastic bags and bricks. Gravel and cobbles of various lithologies (*associated with former railway embankment*).	All contaminant concentrations were below the limits of detection or below the commercial guideline values. A pH of 5.8 at 0.5m bgl and 5.9 at 1.4m bgl is slightly below the value of 6 – 8 for uncontaminated soils. A concentration of 1140mg/kg was detected for acid soluble sulphate which is elevated in relation to the protection of sub surface concrete [23].
TP182	Ch 10+550	0.5, 1.8	A significant thickness of topsoil of 0.7m overlying 0.9m of possible reworked natural ground described as slightly sandy slightly clayey peat (*associated with former railway embankment*).	All contaminant concentrations were below the limits of detection or below the commercial guideline values. A pH of 5.9 at 0.5mbgl is slightly below the value of 6 – 8 for uncontaminated soils. A concentration of 1140mg/kg was detected for acid soluble sulphate which is elevated in relation to the protection

Exploratory Hole	**Chainage**	**Sample depths (m)**	**Geological Description (*and Origin*)**	**Summary of Results**
				of sub surface concrete [23].
TP25	Ch 10+780	0.5, 1.0	Thin layer of topsoil 0.2m thick overlying 1.3m of reworked natural material described as firm brown slightly sandy gravelly silt comprising clasts of various lithologies (*associated with historic area of former railway line*).	All contaminant concentrations were below the limits of detection or below the commercial guideline values. Note: These are scientifically based generic assessment criteria to help evaluate long-term risks to human health from chemical contamination in soil.
TP184	Ch 11+030	0.8	0.4m of topsoil overlying possibly reworked natural ground described as slightly sandy slightly gravelly slightly clayey silt with cobbles and boulders of various lithologies (*associated with historic agricultural activity*).	All contaminant concentrations were below the limits of detection or below the commercial guideline values. A pH of 5.8 at 0.8mbgl is slightly below the value of 6 – 8 for uncontaminated soils. A concentration of 819mg/kg was detected for acid soluble sulphate which is elevated in relation to the protection of sub surface concrete [23].
TP185	Ch 11+230	0.2	0.2m of topsoil overlying 0.55m of made ground described as slightly sandy slightly gravelly clay with a high cobble and boulder content of various lithologies including concrete (*associated with historic levelling of ground adjacent to existing A8*).	All contaminant concentrations were below the limits of detection or below the commercial guideline values. A concentration of 850mg/kg was detected for acid soluble sulphate which is elevated in relation to the protection of sub surface concrete [23].
TP32	Ch 13+580	0.5, 1.0	0.9m of made ground described as slightly sandy gravelly silt with pieces of white subangular to subrounded fine to medium limestone *(associated with historic area of former railway line).*	All contaminant concentrations were below the limits of detection or below the commercial guideline values. Concentrations of 1130 mg/kg and 3280mg/kg of acid soluble sulphate were detected at 0.5m bgl and 1.0m bgl

Exploratory Hole	**Chainage**	**Sample depths (m)**	**Geological Description (*and Origin*)**	**Summary of Results**
				respectively, which is elevated in relation to the protection of sub surface concrete [23].
TP207	Ch 13+630	0.5 (2 No. samples)	Thin layer of Bitmac overlying 0.35m of road base stone (*associated with access to field off existing A8*).	All contaminant concentrations were below the limits of detection or below the commercial guideline values. A pH of 8.4 at 0.15mbgl is slightly above the value of 6 – 8 for uncontaminated soils.
TP211	Ch 14+090	0.25, 0.75	1.1m of made ground described as slightly sandy gravelly clayey silt composed of concrete blocks, kerbs, metal bracing and a high cobble content of basaltic lithology (*associated with Roads Service Depot*).	All contaminant concentrations were below the limits of detection or below the commercial guideline values. A pH of 8.2 at 0.25mbgl and 8.1 at 0.75mbgl are slightly above the value of 6 – 8 for uncontaminated soils. The source of this high pH is likely to be the concrete within the soil.
TP212	Ch 14+090	0.5, 1.0, 1.5	Two distinct units of made ground with respective thicknesses of 1.35 and 1.75m. The upper unit is described as a hardcore in a matrix of grey, very silty, fine to coarse grained sand. Whereas the lower unit is a soft to firm grey/brown slightly gravelly, slightly sandy silty clay. Gravel is fine to medium grained, subangular to subrounded of various lithologies (*associated with Roads Service Depot*).	All contaminant concentrations were below the limits of detection or below the commercial guideline values. pH values of 8.5 at 0.1m bgl, 9.4 at 0.5mbgl, 10 at 1.0mbgl and 10 at 1.5m are above the value of 6 – 8 for uncontaminated soils. The source of this high pH may be the concrete within the soil.
BH125	Ch 14+290	1.3	0.1m of topsoil overlying 2.4m of possibly reworked natural ground described as slightly sandy gravelly silty clay with a high cobble and boulder content (*associated with farm track leading to existing underpass*).	All contaminant concentrations were below the limits of detection or below the commercial guideline values.

11.7 Environmental Design

11.7.1 Soil Contamination

Desk studies and ground investigations to date have revealed a relatively low potential of encountering significant areas of contamination during construction. However, should contamination be identified along the proposed route, this will be treated or disposed of during the construction phase in accordance with an appropriate construction plan to be developed by the contractor. This will reduce the potential future impact that contaminants may have on soils or ground and surface water if leached.

The construction of the scheme will result in the capping of made ground that is present in the areas around TP170, TP172, BH118, TP182, TP185, TP203, TP207, TP211, TP212 and TP213.

The construction of the scheme will also result in the removal of made ground around TP127, BH105 and TP184.

11.8 Assessment of Effects due to Construction

No designated geological or geomorphological sites such as Regionally Important Geological/Geomorphological Sites (RIGS) or ASSIs have been identified which would be affected by the proposed scheme.

Construction involving the creation of embankments would involve excavation and replacement and / or geotechnical improvement of soft alluvial deposits where these soils have insufficient strength and/or compressibility characteristics to provide a suitable formation for the road construction. The proposed scheme will be constructed over such soft material at several locations. Relatively small extents of peat have been identified across the valley bottom of the Larne / Inver River on which embankments will be constructed which will also require excavation and replacement and/or improvement. Peat is important in terms of storing groundwater; however the amount of peat that may require removal / remediation is likely to be small. These peat deposits are not of local importance, therefore the loss of these materials is assessed as ***neutral.***

Construction work would typically involve excavation and removal of glacial deposits to depths in the order of 2m to 5m at five locations along the proposed scheme. At one location to the north of Ballynure a cutting is likely to remove up to 12m of glacial deposits. Where practicable or possible, excavated materials shall be re-used as structural and / or embankment fill, together with imported material. Material geotechnically unsuitable for reuse may be used as landscape fill where required along the route. Therefore, the effect of construction on the geological resources of the site is assessed as ***neutral.***

For the offsite disposal of excavated materials, there are several registered landfill sites within the district, which may accept excavated material. These include:

- Biffa Waste Services Ltd - Bairds Brae Landfill Site (Cottonmount), 140 Mallusk Road, Newtonabbey, BT36 8QN;
- Biffa Waste Services Ltd - Ballyclare Landfill Site, Green Road, Ballyclare, BT39 9PJ;

- D J McKee & Sons - Ballyrickard Road, Larne;
- Kilroot Power Ltd - Kilroot Power Station, Larne Road, Carrickfergus, BT38 7LX;
- Macwill Services - 59 Upper Hightown Road, Belfast, BT14 8RR.

Local quarries may also accept excavated material.

Nonetheless, waste needs to meet certain criteria before it can be disposed of. This is dictated by the Waste Acceptance Criteria, which outlines the acceptance criteria of specific types of landfills.

Construction work including the creation of some cuttings will involve the excavation of cuttings into the basalt bedrock. The locations and depths of the proposed new exposures are shown on **Drawing A8-S3-3300 Appendix F, ES Volume II**. A 1.5 km length cutting of up to approximately 12m depth is proposed west of Ballynure and will be excavated a significant depth into the basalt bedrock resulting in the creation of new exposures of geological / geomorphological interest. A cutting at the A57 (Templepatrick Road) junction and some relatively shallow cut earthworks to the north west of Ballynure at Ballybracken Road Junction are also anticipated to intersect bedrock. Where practicable or possible, excavated materials should be re-used as structural and / or embankment fill, together with imported material. The effect of construction on new geological / geomorphological features is assessed as ***slight beneficial.***

Construction work including the construction of embankments over areas that may have previously been mined has the potential to accelerate the natural rate of subsidence / collapse of shallow underground mine workings. Geological maps and GSNI mine records show that to the north of Ballynure, within the vicinity of Ballynure Fair Hill, historic mining activities have taken place that have exploited the iron ore and bauxite within the Inter-basaltic Bed. However, the majority of the recorded mine workings are situated to the east of the proposed scheme.

The Inter-basalt Bed intersects the proposed scheme at shallow depth to the north west of Ballynure away from the recorded mine workings. Although this area has potential to be underlain by historic mine workings at depths that could potentially impact on the scheme, the main ground investigation[70] did not identify any mine workings beneath the route. Furthermore, during the course of the construction works, this length of the proposed scheme will be excavated to below rockhead level. Therefore, any historic mine workings that may be present over the area at risk, are likely to be identified and may therefore be dealt with as part of the construction works. The effect is therefore assessed as ***neutral.***

The proposed scheme is not considered to have a significant effect on geology and soils away from the proposed scheme, i.e. greater than 50m away. Therefore, environmental assessment of the geology and soils has not been considered necessary outside this area. The effect of construction on geology and soils away from the proposed scheme is assessed as ***neutral.***

The construction of the road would result in the removal of made ground around TP127, BH105 and TP184. This material may be reused if uncontaminated, however, it may require sorting to remove unsuitable materials prior to reuse. The effect is assessed as ***slight beneficial.***

Made ground was predominantly encountered to the north west of Ballynure towards Larne. The construction of the road would result in the capping of the made ground that is present in the area around TP170, TP172, BH118, TP182, TP185, TP203, TP207, TP211, TP212 and TP213. The effect is assessed as ***slight beneficial.***

Desk studies and ground investigations to date have revealed a relatively low potential of encountering contamination during construction. Nonetheless there is still some potential for ground workers to be exposed to 'unidentified' contamination within the made ground, including within existing drains and ditches. This effect is assessed as being ***neutral.***

11.9 Mitigation of Effects due to Construction

Mitigation aims to reduce the loss of geological resource and avoid the mobilisation of potential contaminants during construction, whilst enabling investigation and study of the resource over the long term.

Wherever possible, adverse effects would be avoided through appropriate design. Where this is not possible, controls should be adopted during the construction process to ensure the appropriate management of construction materials and to prevent workers from being exposed to potentially contaminated materials.

Although there is considered to be a low risk of significant contamination being present within the scheme assessment area, it is possible that during the works previously unencountered areas of contaminated material may be discovered.

As discussed within chapter 11.5.1 there is a risk that additional areas that have not been identified to date may contain contamination. Appropriate control measures would need to be incorporated into the construction phase to deal with any unidentified contamination that may be encountered.

Minimum site precautions and ground works should be undertaken in accordance with the Code of Construction Practice (CoCP) detailed in chapter 5.8, and appropriate to the ground risks on the site to prevent pollution of ground and surface waters, and to protect human health.

Although all contaminant levels were below SGVs, possible refuse was encountered in TP127, TP181, TP211 and TP213. It is therefore recommended that made ground material from the vicinity of TP127, TP181, TP211 and TP213 is not re-used in the construction works without further investigation and / or sorting to remove inappropriate material.

11.10 Residual Effects due to Construction

As described in chapter 11.8, the construction of the A8 Dualling will create new exposures of bedrock and will cap potential areas of contamination. With the implementation of control and mitigation measures during the construction phase, the residual effects due to construction are ***slight beneficial***.

11.11 Assessment of Effects due to Operation

Operational phase effects are considered to include those associated with the permanent operation of the A8 Dualling scheme.

For the operational phase of the scheme, potential effects in relation to materials and contamination have been considered. These include fuel and chemical spills as a result of accidents, general vehicle or road degradation, incomplete fuel combustion and atmospheric deposition.

The scheme design includes suitable drainage systems with hydrocarbon interceptors (petrol interceptors) incorporated in the design to capture road run-off and prevent potential contamination of the materials beneath and the surrounding environment. It is therefore considered that there would be no significant operational effects on the underlying superficial or bedrock geology. The effect is assessed as ***neutral.***

Soils adjacent to the road may be affected by spray or air borne pollutants. The effect is assessed as ***slight adverse.***

11.12 Mitigation of Effects due to Operation

There are considered to be no significant effects from the operation of the A8 Dualling, hence no mitigation measures are required.

11.13 Residual Effects due to Operation

There are considered to be no significant residual effects from the operation of the A8 Dualling, therefore no particular mitigation measures are necessary.

11.14 Cumulative Effects

There are considered to be no significant cumulative effects from the A8 Dualling scheme, and therefore no particular mitigation measures are necessary.

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12 Road Drainage and the Water Environment

12.1 Introduction

This chapter presents an assessment of the effects upon the water environment as a result of upgrading a 14km stretch of the A8 (Coleman's Corner to Ballyrickard Road) from single carriageway to dual carriageway standard.

In this context, the water environment includes surface watercourses, water bodies, groundwater and aquifers.

The assessment aims to ensure that the road drainage and surface water drainage systems associated with the scheme mitigate or enhance the effects upon:

- The quality of either the surface or groundwater systems be it due to routine runoff or spillages of hazardous material, and
- The existing local drainage pattern and flood regime.

Potential impacts relating to fish and other species that inhabit the water environment are discussed in chapter 8 'Nature Conservation'.

12.2 Legislation and Guidance

Apart from general statutory and planning requirements for a development of this nature, the water resources aspects are regulated by a number of EU, Northern Ireland and Local instruments, comprising but not limited to:

- Directive 2006/44/EC (the Fish Directive (consolidated)) (FD);
- Council Directive 91/271/EEC concerning urban waste water treatment (as amended) (UWWT Directive (consolidated));
- Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources (as amended) (the Nitrates Directive (consolidated);
- The Water (Northern Ireland) Order 1999;
- The Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2003;
- The Surface Waters (Fishlife) (Classification) Regulations (Northern Ireland) 1997 (as amended);
- The Water Abstraction and Impoundment (Licensing) Regulations (Northern Ireland) 2006;
- The Environmental Liability (Prevention and Remediation) Regulations (Northern Ireland) 2009; and
- The Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 (as amended);
- The Drainage (Northern Ireland) Order 1973 (as amended);
- The Drainage (Environmental Effect Assessment) Regulations (Northern Ireland) 2006;
- The Groundwater Regulations (Northern Ireland) 2009;

- The Pollution Prevention and Control Regulations (Northern Ireland) 2003;
- The Fisheries Act (Northern Ireland) 1966 (as amended);
- Northern Ireland Biodiversity Strategy;
- Northern Ireland Biodiversity Implementation Plan April 2009 to March 2012;
- Northern Ireland River Conservation Strategy; and
- PPS 15: Planning and Flood Risk (DOE June 2006).

12.3 Scoping and Consultation

12.3.1 Scoping

An ES Scoping Report was issued in March 2010 to key statutory and non-statutory bodies outlining the approach, methodology, baseline conditions and expected effects of the scheme.

It was circulated to all stakeholders, offering them an opportunity to address the proposed methodologies for the EIA or to address issues that have not been adequately covered. A list of consultees is included in chapter 7.3.

A more detailed summary of the responses received and the respective changes made to the scope of the EIA Road Drainage and Water Environment assessment are summarised in Table 49.

Table 49 **Response of consultees and changes to scope of EIA**

Consultees	Consultees Responses	Changes made to scope of EIA
Northern Ireland Environment Agency	The following pieces of legislation which are related to water quality have not been included in the scoping document: The Water Abstraction and Impoundment (Licensing) Regulations (Northern Ireland) 2006; The Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 (as amended); The Environmental Liability (Prevention and Remediation) Regulations (Northern Ireland) 2009.	The aforementioned regulations will be referred to in the EIA.
	Recommends that the River Basin Management Plans and their accompanying ‘Mechanisms For Action’ and ‘Register of Plans and Programmes’ be addressed.	The River Basin Management Plans and their accompanying ‘Mechanisms For Action’ and ‘Register of Plans’ have been considered within the EIA.
	Scoping report does not identify the current status of each water body or the specific water quality objectives set under the	EIA will consider the following: Water bodies that may be affected by the scheme; The current status of each water body;

Consultees	Consultees Responses	Changes made to scope of EIA
	requirements of the Water Framework Directive.	Water quality objectives for each water body, for at least 2015; Assessment of the potential impacts on the current status of each water body and on future water quality objectives; and An assessment of how the scheme will impact upon the programme of measures for each Local Management Area.
	Pollution prevention want an additional assessment carried out to assess the potential effects of site runoff during the construction phase.	The risk of pollution during construction has been assessed using a qualitative methodology based on the DMRB assessment methodology set out in HD 45/09
	Pollution prevention want to see the following Pollution Prevention Guidelines considered – PPG1, PPG2, PPG3, PPG4, PPG5, PPG6, PPG7, PPG8, PPG11, PPG13, PPG21, PPG22.	A Code of Construction Practice has been produced for the development, to manage environmental impacts during construction. The code will be developed further by the contractors to include all of the relevant measures identified in the relevant PPGs.
	DCAL Inland Waterways and Fisheries should be included as a consultee.	DCAL Inland Waterways and Fisheries has been included as a consultee.
	Reference has been made to the Groundwater Regulations (Northern Ireland) 1998. These Regulations have been replaced by the 2009 Regulations.	The Groundwater Regulations (Northern Ireland) 2009 will be referred to instead of the Groundwater Regulations (Northern Ireland) 1998.

12.3.2 Consultation

Additional consultation and liaison with statutory consultees has taken place throughout the scheme design of the A8 Dualling. A list of stakeholders consulted and a summary of key issues discussed during the process is presented in chapters 7.2.2 to 7.4.

12.4 Assessment Methodology

The effects of the proposed scheme on water quality and drainage have been assessed in accordance with the methodology given in the Design Manual for Roads and Bridges (DMRB) Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 10: HD 45/09 Road Drainage and the Water Environment[71], subsequently referred to as HD 45/09 in this section. This guidance provides a methodology and criteria for predicting the likely significant effects and magnitude of a proposed road scheme on the water environment.

There are four assessment components to the DMRB approach, which include:

[71] Highways Agency; www.standardsforhighways.co.uk/dmrb/vol11/section3/11s3p10.pdf

- Determining the effect from routine highway runoff on surface watercourses;
- Determining the effect from routine highway runoff on the quality of groundwater resources;
- Predicting the likelihood of an accidental spillage causing pollution to receiving water bodies; and
- Assessing flood risks.

The predicted potential effects have been considered for both construction and operational phases of the proposed road scheme.

12.4.1 Methodology for Establishing Baseline Conditions

The drainage and water environment baseline data has been assembled from a combination of Ordnance Survey maps, desktop studies, field surveys and site reconnaissance. These have been supplemented by consultations with a number of statutory organisations, Newtownabbey and Larne Borough Councils, and by a programme of targeted water quality monitoring.

This enabled the baseline to be established with respect to:

- The level of sensitivity and water quality of the receiving waters;
- Hydrological, hydrogeological and groundwater vulnerability;
- The location, number and type of abstraction and discharge licenses within the local area; and
- Regional and local drainage and flooding concerns.

12.4.1.1 Methodology for Establishing Surface Water Baseline

The study considered surface water features up to 250m either side of the proposed scheme, to identify features of the water environment potentially affected by the scheme. Where necessary this area was extended as required, for example further downstream for watercourses. This area is considered appropriate for the potential risk to surface water posed by the scheme.

Surface Water Quality – Water Framework Directive Classifications

Since the publication of the draft Water Framework Directive (WFD) River Basin Plans in December 2008, General Quality Assessment (GQA) has been superseded by WFD classification.

The WFD classification referees to a unit of area, a ‘water body’ is the classification unit rather than discreet stretches of individual rivers, as under the GQA, see below. Therefore, for some water bodies containing more than one river and/or monitoring stations, data from individual stations is combined to produce an overall classification.

The classification is based on a 5-band system comprising ‘High’, ‘Good’, ‘Moderate’, ‘Poor’, and ‘Bad’. A wide range of determinants are considered including both chemical and ecological parameters, such as macrophytes (aquatic plants), hydromorphology (river type and structure) and fish. These are considered in relation to their overall impact rather than separately.

NIEA provided the WFD Classifications for Six Mile Water, Castle Water, Six Mile Water, Green Burn, Ballylinny Burn, Lisnalinchy Burn and Larne River.

Surface Water Quality – General Quality Assessment

Prior to the WFD Classifiaction scheme NIEA used GQA. GQA data was also provided by the NIEA as baseline information for the scheme.

The NIEA monitors the water quality of rivers using the GQA classification scheme. The scheme defines standards for chemical and biological quality of river water and is designed to assess the state of water quality and how it changes over time. Data have been provided by the NIEA to further inform the baseline.

The Chemical GQA assesses quality in terms of three indicators associated with organic pollution (dissolved oxygen, biochemical oxygen demand and ammonia) however these indicators do not effectively address the impact of highway drainage as the predominant chemical parameters associated with highway drainage are hydrocarbons, metals (zinc, copper and cadmium) and chlorides from road salt. The Biological GQA monitoring looks at the abundance and diversity of macroinvertebrates that live in the river. The GQA classification scheme categorises water quality into six discrete classes, from Very Good, through Fair, to Bad Quality, using nationally accepted criteria. A full description of this categorisation system is available on the NIEA website[72].

The NIEA provided GQA grades and measured water quality data for Six Mile Water, Castle Water, Green Burn, Ballyliny Burn and Larne River. No baseline water quality data exists for the other receiving watercourses. Where no GQA grade has been defined, HD 45/09 states that the classification from the first downstream watercourse should be used.

Surface Water Quality - Measured

A programme of targeted water quality monitoring was initiated in December 2009 (winter). The programme involved the collection of water samples from receiving watercourses at 14 locations where surface water discharges are proposed. To determine seasonal variability, a total of four samples were scheduled over a 12-month period, one in each season, to measure the existing water quality. Samples were tested in field for unstable parameters of temperature, pH and dissolved oxygen. They were then submitted to accredited laboratories to be analysed for the following:

- Total Suspended Solids (TSS);
- Biological Oxygen Demand (BOD);
- Ammoniacal Nitrogen;
- Total Ammonia;
- Copper Dissolved;
- Zinc Dissolved;
- Nitrite as N;
- Total Hardness; and

[72] NIEA, Biological and Chemical Classifications for 2004 to 2007 in Northern Ireland, http://www.ni-environment.gov.uk/water/quality/rivers/river_results.htm

- TPH / Oil & Greases.

Six Mile Water, Castle Water and Larne River are all designated as Salmonid Waters under the Directive 2006/44/EC (the Fish Directive (consolidated)) (“FD”)[73]. The water quality results are therefore compared against water quality standards (WQS) as contained in Annex II to this Directive.[74]

12.4.1.2 Methodology for Establishing Groundwater Baseline

The groundwater baseline has been assessed on the basis of groundwater conditions of up to 1.5km either side of the proposed scheme, which is considered an appropriate distance to establish hydrogeological conditions that may be affected by the proposed scheme.

Information was obtained from the desktop study carried out as part of the preliminary sources study, historic ground investigations, the preliminary ground investigation undertaken in October 2008 and the main ground investigation undertaken between October 2009 and May 2010. Information was obtained to inform the baseline conditions regarding both groundwater quality and groundwater levels for the scheme.

Published geological memoirs and geological, hydrogeological and groundwater vulnerability plans were reviewed to develop the conceptual model of the ground conditions[75], assess the sensitivity of groundwater receptors, and identify locations of potentially contaminated land.

A review of existing historical plans and a series of site walkovers were carried out to indentify locations of wells, springs, rises and other groundwater features within the area.

A comprehensive ground investigation was carried out along the route to identify the ground and groundwater conditions. This included groundwater level monitoring, groundwater sampling and associated quality testing. In situ permeability testing of soils and bedrock was also carried out to further inform the hydrogeological assessment.

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73 Council Directive 2006/44/EC of 6 September 2006 on the quality of fresh waters needing protection or improvement in order to support fish life

74 Directive 2006/44/EC the Fish Directive (consolidated), Annex II: Particulars regarding Total Zinc and Dissolved Copper;
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:264:0020:0031:EN:pdf

75 The Geology of Northern Ireland, Our Natural Foundation. Geological Survey of Northern Ireland (2004).
Regional Geology of Northern Ireland. Geological Survey of Northern Ireland (1972).
Geology of the country around Carrickfergus and Bangor. Geological Survey of Northern Ireland, 2nd Ed. (1982).
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Antrim, Northern Ireland Sheet 28, 1:50,000 Solid and Drift Geology Plan. Geological Survey of Northern Ireland (1994).
Carrickfergus, Northern Ireland Sheet 29, 1:50,000 Solid and Drift Geology Plan. Geological Survey of Northern Ireland (1968).
Hydrogeological Map of Northern Ireland, 1:250,000. Environment Service, Department of the Environment for Northern Ireland (1994).
Groundwater Vulnerability Map of Northern Ireland, 1:250,000. Environment Service, Department of the Environment for Northern Ireland (1994).

Consultation was held with the NIEA, Northern Ireland Water Limited (NI Water), Newtownabbey Borough Council and Larne Borough Council to obtain information regarding abstraction licenses, discharges consents, pollution incidents groundwater quality and groundwater levels.

12.4.1.3 Methodology for Establishing Accidental Spillage Baseline

Accidents occurring on roads can lead to the spillage of potentially polluting substance onto the road surface and into the road drainage system, from where they may rapidly enter the water bodies that receive highway drainage. There is particular risk if the accident involved a Heavy Goods Vehicle (HGV) carrying liquids such as fuel, oil, chemicals or organic liquids, all of which have the potential to cause a pollution incident.

The NIEA produce an annual report detailing statistics relating to water pollution incidents throughout Northern Ireland. Pollution incidents are classified by Source, Category, Cause, and Severity. Baseline data detailing pollution incidents relating to the study area have been extracted from the NIEA 2009 Annual Report[76].

12.4.1.4 Methodology for Establishing Flood Risk Baseline

The scheme assessment area for the water environment extends west to Six Mile Water and east to include Castle and Bryantang Water. This area falls within North Eastern and the Neagh Bann River Basin Districts and within two river catchment areas:

- Six Mile Water - the southern part of the scheme assessment area, including Ballynure;
- Inver River - northern part of the scheme assessment area.

Methodology for Determining Peak Flow

The Q100 Peak Flow was calculated using both the Revitalized Flood Studies report/Flood Estimation Handbook (FEH) rainfall runoff method spreadsheet and the FEH Pooling Group Analysis Statistical Method. The catchment characteristics and descriptors were extracted from the FEH CD-ROM 2.0.

A Qmed (the median annual maximum flood) is required to determine flows in the Statistical Method. Since the subject watercourses are ungauged the Data Transfer Method was used to obtain an adjusted value of Qmed, as specified in FEH Volume 3. Data was transferred from a comparative site (not on the same watercourse) with similar hydrological parameters as the study sites, as a local gauged site on the same watercourse was not available.

Where catchments were so small that there are no catchment descriptors available then either the Institute of Hydrology Report 124 (IH124) Method for catchments >0.4km^2 was used or where the catchment was <0.4km^2 then either a pro rata IH124 value or the ADAS 345 method for calculating peak surface runoff design rates (Peak Flood Flows) was used. This was used for the smaller tributaries that

[76] www.ni-environment.gov.uk/water_pollution_incidents_and_enforcement_2007.pdf

the proposed scheme crossed. Of the Q100 flow rates calculated by the two methods, the largest flow was used for the assessment.

The Q100 peak flows (including a 20% allowance for the global climate change) were used to carry out a backwater analysis in HEC-RAS to determine the water levels in the Six Mile Water, Inver River and their respective tributaries at predetermined locations.

The Q100 floodplain was constructed by projecting the HEC-RAS modelled water levels for the Q100 event onto the 3-D topographical survey. The water levels were extracted from each cross section location within the model.

To ensure the accuracy of the output of the HEC-RAS model, flows were calculated using FEH data for sub-catchments of the larger watercourses, Six Mile Water and the River Inver, with flow contributions gradually increasing as the overall catchment size increased along the length of the river. In some locations however, the peak flows were interpolated based on flows determined in reaches further upstream or downstream of the point of interest e.g. at the confluence between two watercourses.

12.4.1.5 Methodology for Establishing Geomorphology Baseline

A survey was undertaken for all sites where the scheme may potentially affect the geomorphology of surface watercourses. Observations were made on channel form, bank characteristics, substrate material, the presence of geomorphologic process features, and the 'normal flow' hydraulic diversity (normal summer flow conditions accommodated within a definable channel).

In total 7 sites were visited. The site visit revealed that 2 of the sites were field drains and these were not considered any further. Details of the sites are provided in Table 50. The locations of the sites are provided in the geomorphologic report in **Appendix L, ES Volume II**.

Table 50 **Site location details**

Site Number	A8 Road Chainage (m)	Survey Length (m)	River Name and Location Description
2	5600	250	Ballynure Water – Around existing Church Road masonry arch bridge.
4	12000	500	Larne River - South of Quarry
5	12500	400	Larne River - North of Quarry
6	12900	250	Larne River – North of Stewardstown Drive
7	13800	250	Glen Burn – Around existing Lowtown Bridge

12.4.2 Methodology for Assessment of Effects due to Construction

Effects to the water environment arising due to the construction phase will depend on a combination of the potential for pollution and flooding (type of activities), the sensitivity of the receptor and the effectiveness of control measures.

The assessment of effects during construction, for impacts to the water quality, groundwater and the flood plain is based on an approach informed by HD 45/09. The methodology consists of four stages:

- Stage 1: Identification of water features and their attributes that may be affected and the indicators to monitor those effects;
- Stage 2: Assessment of the importance/value/sensitivity of any identified receptor using the criteria in Table 53;
- Stage 3: Assessment of the magnitude of the effect of construction on the receptor using the criteria in Table 54; and
- Stage 4: Assessment of the significance of effects, based on the importance of the receptor and the magnitude of the effect of construction using Table 55.

12.4.2.1 Methodology for Assessment of Effects due to Operation on Surface Water

An assessment of the potential impacts of routine runoff on surface waters has been undertaken to determine whether there is an environmental risk and if pollution mitigation measures are needed. The assessment was done in line with HD 45/09 and used the Highways Agency Water Risk Assessment Tool (HAWRAT). HAWRAT has been developed specifically for the purpose of supporting Water Quality assessments carried out as part of an assessment. The tool requires certain site-specific data to make an assessment, including the Annual Average Daily Traffic (AADT) data for the design year (2031) location details, and data relating to the receiving watercourse.

HAWRAT adopts a tiered consequential approach to assessment and can report the results at different steps. At Step 1 HAWRAT predicts the statistical distribution of key pollutant concentrations in untreated and undiluted highway runoff (worst case scenario) and is reported as a pass/fail. At Step 2 HAWRAT uses details of the highway catchment draining to the outfall, the flow rate of the receiving watercourse and its physical dimensions to calculate the available dilution of soluble pollutants and potential dispersion of sediments. A further comparison with pollutant thresholds is then made.

HAWRAT uses a pass/fail reporting method whereby:

- ‘Fail’ indicates either: an unacceptable impact; a need to carry out further assessment steps; or a need to refer the situation to specialist judgement.
- ‘Pass’ indicates that there will be no short-term impact associated with road runoff.

Where outfalls discharge to the same watercourse of river reach, the combined risk is also assessed using HAWRAT in accordance with the principles in HD 45/09.

Q95 Flow

The watercourse flows at low flow conditions are used in the assessment to determine the in channel concentration of pollutants once diluted by the river flows, as a worst case scenario. The low flow conditions are expressed in terms of the 95th percentile flow (Q95), which is defined as the flow exceeded in a watercourse for 95% of the time. It needs to be highlighted that the Q95 refers to a low flow scenario, where as the Q100 used for the flood modelling refers to a maximum flow rate.

Q95 data was purchased from Wallingford Hydrosolutions using the LowFlows software. Out of the 14 outfalls, seven were located on streams too small for LowFlows to determine. As the geology and topography does not vary considerably over the scheme, the Q95 value was prorated using the catchment size and Q95 data received for the remaining seven outfalls. Table 51 outlines the Q95 determination of watercourses.

Table 51 **Q95 Determination of Watercourses**

Watercourse	Q95 Determination
Ballylinny Burn tributary Green Burn Ballynure Water Six Mile tributary 2 Larne River tributary 2 Larne River Glen Burn	Q95 was obtained from LowFlows software
Ballymena Burn tributary 1 Ballymena Burn tributary 2 and 3 Six Mile tributary 1 Larne River tributary 1 Larne River tributary 3 Larne River tributary 4	Q95 was estimated based on similar catchment sizes received from LowFlows software

12.4.2.2 Methodology for Assessment of Effects due to Operation on Groundwater

Groundwater Quality

Annex I to HD 45/09 provides a methodology (Method C) to assess the potential impact on the quality of groundwater resources from routine runoff discharges to the ground.

This risk assessment procedure is based on the study of the source-pathway-receptor (S-P-R) protocol. The principles of this approach has been applied to the disposal of road drainage whereby the:

(i) Source term comprises the road drainage water with any pollutants contained therein, as it enters any unlined ditch, watercourse or soakaway discharge system, that has the potential to transmit water through the ground to groundwater;

(ii) Pathway term represents the processes, which may modify the pollutants during transmission through the discharge system and soil and subsoil until the actual ‘point of entry’ to groundwater (this includes the unsaturated zone); and

(iii) Receptor, which is the groundwater.

For there to be a risk of impact to groundwater, all elements of the S-P-R model have to be present to create a pollutant linkage. Therefore the risk assessment was only applied to those locations where a pathway to groundwater is present. In accordance with HD 45/09, pathways to groundwater are defined as being present at surface water discharge sites if the Q95 flow is less than $0.001m^3/s$. Discharge to groundwater was not considered at locations where discharges are proposed directly into attenuation ponds which in turn discharge to watercourses. This is due to the proposed construction of attenuation ponds with impermeable linings.

The risk assessment methodology takes account of the different sources of pollution in combination with the pathway characteristics that influence the level of groundwater protection using two matrices.

The method uses Table 52 to determine the risk score, by incorporating the key factors affecting level of risk posed by the source of pollutants, the persistence and movement of pollutants within the pathway to groundwater and linkages between them. In this way the matrix provides a means of ranking specific road drainage discharge sites in terms of their potential risks to groundwater.

Table 52 **Matrix to Determine Risk of Effect of Pollution to Groundwater from Routine Runoff (extract from DMRB, Volume 11, Section 3 – Part 10 HA 45/09, Annex I, Table C.1)**

Component Number		Weighting Factor	Property or Parameter	Low Risk (Score 1)	Medium Risk (Score 2)	High Risk (Score 3)
1	SOURCE	15	Traffic Density (AADT)	<15,000	15,000–50,000	>50,000
2	SOURCE	15	Rainfall Volume (annual averages)	<740mm	740-1060mm	>1060mm
			Rainfall Intensity	Even (<35mm FEH 1 hour rainfall)	Uneven (35-47mm FEH 1 hour rainfall)	Concentrated (>47mm FEH 1 hour rainfall)
3	PATHWAY	15	Soakaway Geometry	Continuous linear (e.g. ditch, grassed channel)	Single point, or shallow soakaway (e.g. (lagoon) serving low road area	Single point, deep serving high road area (>5,000 m^2)
4	PATHWAY	20	Unsaturated Zone	Depth to water table >15m and non-aquifers	Depth to water table <15 but >5m	Depth to water table <5m
5	PATHWAY	20	Flow Type	Unconsolida-ted or non-fractured consolidated deposits (i.e. dominantly intergranular flow)	Consolidated deposits (i.e. mixed fracture and intergranular flow)	Heavily consolidated sedimentary deposits, igneous and metamorphic rocks (dominated by fracture porosity)
6	PATHWAY	7.5	Effective Grain Size	Fine sand and below	Coarse sand	Very coarse sand and above

The overall risk score assigns the proposed discharge points to one of three risk impact classes, namely low, medium or high as follows:

- **Low (overall risk score <150):** The identified risks to groundwater are minimal;
- **Medium (overall risk score 150-250):** Mitigating measure should be considered to protect groundwater, although the need for and nature of the mitigation measures should be informed by additional risk assessment; and
- **High (overall risk score >250):** It is necessary to collect further data and complete a more detailed risk assessment.

In accordance with HD 45/09, an outfall with a low overall risk score will have a minimal risk to groundwater, therefore discharge to groundwater can be selected most effectively to meet the hydraulic requirements of road drainage. A medium overall risk score reflects the situation whereby the groundwater is deemed to be at potential risk from contamination and the outfall will therefore require mitigation measures informed by additional risk assessment. For the high overall risk score scenario, groundwater is also deemed to be at potential risk from contamination and it is necessary to collect further data to complete a more detailed risk assessment. However, it is not anticipated that any outfall will present a high risk to groundwater.

For the medium overall risk score scenario, to identify the extent of a moderate adverse impact, additional groundwater risk assessment comprises the Environment Agency's P20 Hydrological Risk Assessment for Land Contamination. This is a more detailed computer based model, which takes account of transport and fate properties, aquifer properties and contaminant degradation.

The purpose of this additional risk assessment is to demonstrate the level of concern of contamination in relation to specific receptors by determining the distance that a contaminant will reduce in concentration from an initial runoff value to a specific threshold value. Threshold values include UK Drinking Water Standards (UKDWS) or Environmental Quality Standard (EQS) guidelines, whichever is the higher. In this case receptors include groundwater abstraction locations and water courses with a Q95 flow of greater than $0.001m^3/s$.

Initial contaminant concentrations of runoff have been deduced by using the HAWRAT model. This model is intended to be used for surface water risk assessment, however the Q95 flow has been reduced to zero, and therefore runoff represents that entering the groundwater body (following minor attenuation within the unsaturated zone). The P20 risk assessment uses the mean concentrations (annual average) of the soluble marker contaminants copper and zinc, both of which are contaminants of concern within road runoff.

12.4.2.3 Methodology for Assessment of Pollution Impacts from Accidental Spillage during Operation

Spillage rates used in the calculations for accidental spillages have been taken directly from the appropriate sections of HD 45/09.

The assessment of pollution effects from accidental spillage has been carried out using Method D from Annex I to HD 45/09. The spillage risk assessment methodology provides the probability of a serious accident based on the type of road, road length, presence of junctions and roundabouts, AADT, percentage HGVs and spillage rates.

Method D initially estimates the risk that there will be a spillage of a potentially polluting substance somewhere along the length of the road being assessed. Assuming an accident has occurred, this method then calculates the risk that the pollutant will reach and impact on the various receiving water bodies. These risks are expressed as annual probabilities and allow objective decisions to be made as to their acceptability or whether measures are needed to reduce risk. HD 45/09 defines the acceptable level of risk as being an annual probability of less than 1%.

The calculations from Method D was applied for each discharge point and used parameters which included road length, spillage rates, AADT and the percentage of HGVs. The full methodology for Method D can be found in Annex I of HD 45/09.

Once the risk had been calculated, risk reduction factors, as stated in the HD 45/09, were applied for each discharge location, as part of the drainage design for the A8 Dualling. This resulted in a final figure for each discharge location which expressed the reduced annual probability that a spillage would cause a serious pollution incident.

12.4.2.4 Methodology for Assessment of Flood Risk during Operation

The Flood Risk Assessment (FRA) has been undertaken in accordance with the principles of Planning Policy Statement, PPS 15: 'Planning and Flood Risk' (June 2006) and CIRIA C624 Development, Flood Risk – Guidance for the Construction Industry (2004) and Method E from Annex I to HD 45/09.

In addition a detailed assessment of the encroachment was examined between Ch. 12,900 – 13,200 on the east side of the carriageway. A HEC-RAS analysis for the Q_{100} flood on the watercourses with the new highway was carried out and compared to the existing water levels.

12.4.2.5 Methodology for Assessment of Geomorphology during Operation

HD 45/09 does not specifically require assessment of the effect on geomorphology. However due to the scale of river realignments a qualitative assessment of the effects has been undertaken. The method identifies beneficial and adverse impacts on the geomorphology. Cumulative effects on water quality, ecology and other receptors are considered in the relevant sections in this ES.

The scale of the effects are assessed in line with the approach set out in HD 45/09, however in absence of guidance on the importance/sensitivity of the receptors and the scale of impacts these are described qualitatively.

12.4.3 Significance Criteria for Assessment of Effects

The significance of effects on the water environment has been assessed using the methodology contained within the HD 45/09.

For risks posed to the water environment, the significance of the effects has been assessed based on the importance/sensitivity of affected receptor in combination with the magnitude of any effects.

For assessment of the risk posed by accidental spillage, in line with HD 45/09, if the annual probability that a spillage would cause a serious pollution incident to a water body is less than 1%, then the risk posed is considered acceptable and no further assessment has been carried out.

The importance/sensitivities of the receptors potentially affected have been defined in accordance with the criteria set out in Table 53.

Table 53 **Criteria for Determining the Importance/Sensitivity of receptors**

Importance / Sensitivity of Receptor	**Criteria**	**Indicators**
Very High	Attribute has a high quality and rarity on a regional or national scale.	**Surface Water**: EC Designated Salmanoid/Cyprinid fishery. WFD Class 'High' Site protected under European Union (EU) or UK wildlife legislation (Special Area of Conservation (SAC), Special Protected Area (SPA), Area of Special Scientific Interest (ASSI), Ramsar site). **Groundwater**: Principal aquifer providing a regionally important resource or supporting site protected under EC and UK habitat legislation. Sourec Protection Zone (SPZ) 1 **Flood Risk**: Flood plain or defence protecting more than 100 residential properties from flooding.
High	Attribute has a high quality and rarity on a local scale.	**Surface Water**: WFD Class 'Good' Major Cyprinid Fishery, Species protected under EU or UK wildlife legislation. **Groundwater**: Principal aquifer providing locally important resource or supporting river ecosystem. SPZ2. **Flood Risk**: Flood plain or defence protecting between 1 and 100 residential properties or industrial premises from flooding.
Medium	Attribute has a medium quality and rarity on local scale	**Surface Water**: WFD Class Moderate **Groundwater**: Aquifer providing water for agricultural or industrial use with limited connection to surface water. SPZ3. **Flood Risk**: Flood plain or defence protecting 10 or fewer residential or industrial properties from flooding.
Low	Attribute has a low quality and rarity on local scale	**Surface Water**: WFD Class 'Poor'. **Groundwater**: Unproductive strata **Flood Risk:** Flood plain with limited constraints and low probability of flooding residential and industrial properties.

The magnitudes of potential effects have been assessed using Table 54.

Table 54 **Magnitude of an Effect on Water Environment**

Magnitude	**Criteria**	**Typical Example**
Major Adverse	Results in loss of attribute and/or quality and integrity of the attribute.	**Surface Water**: Failure of both soluable and sediment bound pollutants in HAWRAT and compliance failure with EQS values. Calculated risk of pollution from accidental spillage >2% annually. Loss or extensive change to a fishery. Loss or extensive change to a designated Nature Conservation Site**.** ***Groundwater*****:** Loss of, or extensive change to, an aquifer. Potential high risk of pollution to groundwater from routine

Magnitude	Criteria	Typical Example
		runoff (risk score >250) Calculated risk of pollution from accidental spillage >2% annually. ***Flood Risk***: Increase in peak flood level (1% annual probability) >100mm
Moderate Adverse	Results in loss of attribute and/or quality and integrity of attribute	***Surface Waters****:* Failure of both soluble and sediment-bound pollutants in HAWRAT but compliance with EQS values. Risk of pollution from spillage >1% annually and <2% annually Partial loss in productivity of to a fishery. Effect on the integrity of the existing flora and fauna. ***Groundwater:*** Partial loss or change to an aquifer. Potential medium risk of pollution to groundwater from routine runoff (risk score 150-250) Calculated risk of pollution from spillage >1% annually and <2% annually. Partial loss of the integrity of groundwater supported designated wetlands. ***Flood Risk***: Increase in peak flood level (1% annual probability) >50mm.
Minor Adverse	Results in some measurable change in attributes quality or vulnerability.	***Surface Waters*****:** Failure of either soluble or sediment-bound pollutants in HAWRAT. Risk of pollution from spillage >0.5%. ***Groundwater:*** Potential low risk of pollution to groundwater from routine runoff (risk score <150). ***Flood Risk:*** Increase in peak flood level (1% annual productivity) >10mm.
Negligible	Results in effect on attribute but of insufficient magnitude to affect the use or integrity	***Surface Water***: No risk identified by HAWRAT (pass both soluable and sediment-bound pollutants). Risk of pollution from accidental spillages <0.5% annually. ***Groundwater:*** No predicted change in quality of any type of aquifer Risk of pollution from accidental spillages <0.5% annually. ***Flood Risk***: Negligible change in peak flood level (1% annual probability) <±10mm.
Minor Beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring	***Surface water:*** HAWRAT assessment or either soluble or sediment-bound pollutants becomes a Pass from an existing site where the baseline was a Fail condition. Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is <1% annually) (Method D). ***Groundwater:*** - Calculated reduction in existing pollution risk from accidental spillages by 50% or more to an aquifer (when existing spillage risk is <1% annually) (Method D). ***Flood Risk***: Reduction in peak flood level (1% annual probability) >10mm.
Moderate Beneficial	Results in moderate improvement of attribute quality	***Surface Water***: HAWRAT assessment of both soluable and sediment bound pollutants Pass from an existing site where the baseline was a Fail condition. Calculated reduction in existing spillage by 50% or more (when existing spillage risk >1% annually) (Method D). ***Groundwater:*** - Calculated reduction in existing pollution risk from accidental spillages by 50% or more to an aquifer (when

Magnitude	Criteria	Typical Example
		existing spillage risk >1%) (Method D). ***Flood Risk:*** Reduction in peak flood level (1% annual probability) >50mm.
Major Beneficial	Results in major improvement of attribute quality	***Surface Water***: Removal of existing polluting discharge, or removing the likelihood of polluting discharge occurring to a watercourse. ***Groundwater:*** Removal of existing polluting discharges to an aquifer or removing the likelihood of polluting discharges occurring. Recharge of an aquifer. ***Flood Risk:*** Reduction in peak flood level (1% annual probability) >100mm.

The significance of potential effects was then determined using

Table 55, by comparison of the identified importance/sensitivity of the receptors with the estimated magnitude of the effect. Effects were either beneficial or adverse, as defined by Table 54.

Table 55 **Significance of Effects on Water Environment**

		Magnitude of Impact			
Importance of Attribute		**Negligible**	**Minor**	**Moderate**	**Major**
	Very High	Neutral	Moderate / Large	Large / Very Large	Very Large
	High	Neutral	Slight / Moderate	Moderate /Large	Large / Very Large
	Medium	Neutral	Slight	Moderate	Large
	Low	Neutral	Neutral	Slight	Slight / Moderate

The definitions of the significance values are further explained in Table 56.

Table 56 **Definitions of Significance Values**

Score	Comment
Very Large Adverse	Where the proposed development would result in degradation of the water environment because it results in predicted very significant adverse impacts on at least one water attribute and/or on several water attributes.
Large Adverse	Where the proposed development would result in degradation of the water environment because it results in predicted highly significant adverse impacts on a water attribute and/or significant adverse impacts on several water attributes.
Moderate Adverse	Where the proposed development may result in the degradation of the water environment because it results in predicted moderate adverse impacts on at least one attribute.
Slight Adverse	Where the proposal may result in a degradation of the water environment because it results in a predicted slight impact on one or more attributes.

Score	Comment
Neutral	Where the net impact of the proposed developments is neutral, because it results in no appreciable effect, either positive or negative, on the identified attributes.
Slight Beneficial	All other situations where the proposed development provides an opportunity to enhance the water environment or provide an improved level of protection to an attribute.
Moderate Beneficial	Where the proposed development provides an opportunity to enhance the water environment because it results in a moderate improvement for an attribute.
Large Beneficial	It is unlikely that any proposed development incorporating the construction of a new or improved trunk road would fit into this category. However, proposals could have a large positive impact if it is predicted that it will result in a 'very' or 'highly' significant improvement to a water attribute(s), with insignificant adverse impacts on other water attributes.

12.5 Limitations and Assumptions

12.5.1 Limitations

Assessment of the drainage and the water environment aspects of the scheme have been carried out in accordance with HD 45/09. Limitations associated with the recommended methods are discussed in detail in this document.

The baseline water quality of the watercourses not included in the NIEA routine sampling programme is based on four water quality sampling events, including December 2009 (Winter), March 2010 (Spring) and June 2010 (Summer) and September 2010 [77](Autumn). This is considered sufficient, particularly as the assessment is also based on the watercourses designation as salmonid waters.

There is an inherent uncertainty associated with the LowFlow model estimate of annual Q95, which is ±26%. However this method is considered to the best most accurate method for estimating Q95 for specific locations within a catchment where no detailed flow data is available for the specific location.

The groundwater quality baseline for the scheme was established on the basis of sampling and testing from 15 monitoring locations installed during the main ground investigation. Whilst the number of sample locations was limited to those areas that were accessible and practical, the sampling and testing regime that has been carried out for the scheme is considered sufficient for the purpose of identifying the groundwater baseline conditions for the area. The number of monitoring locations is considered sufficient given the predominantly greenfield nature of the surroundings and relatively low potential for contaminants to enter the receiving groundwater body.

The groundwater quality baseline was established on the basis of groundwater sampling and testing over a three month period. This information has been

[77] September 2010 water sampling has been undertaken and the data is currently being analysed in the laboratory.

supplemented by data provided by NIEA for a single monitoring location to inform the baseline of seasonal variation of groundwater quality.

Groundwater level monitoring was carried out over a good spatial coverage of the proposed scheme. However, water levels within the different holes were monitored over different periods, which were dependent on when the boreholes were completed and when monitoring installations were available. Constraints associated with land access delayed the main ground investigation, therefore monitoring of groundwater levels within some areas has been ongoing since May 2010. Whilst the periods over which groundwater monitoring has been carried out do not directly coincide for the various installations, sufficient monitoring has been carried out across the length of the proposed route for reasonable equilibrium groundwater levels to be estimated for the groundwater assessment. Installations are still available, and it is proposed that groundwater level monitoring is continued up until construction commences, therefore offering potential for the estimated equilibrium groundwater levels to be verified in future.

For the purpose of the risk assessment associated with routine runoff discharging to groundwater, the location of abstraction locations has been determined through two means. Firstly abstraction licences for public and private supply, historic abstractions and abstraction licence applications have been compiled from discussions with NIEA Water Management Unit, Newtownabbey and Larne Borough Council. Secondly a review of historical information also established the location of wells. It should be noted that further abstraction locations may exist along the proposed scheme and if present they may be impacted upon due to construction and/or operation of the A8. Efforts have been put in place to finalise this data set through consultation with land owners and the assessment was carried out using data provided by 16/11/2010.

Drawings provided by Rivers Agency provided an overall indication of the approximate river profile and locations of potential structures along the river channel. However the drawings provided are associated with consultation work and design carried out in the 1980s, with the most recent drawings being revised in January 1989. It cannot be assumed that the drawings provide an accurate account of the present situation.

12.5.2 Assumptions

The assessment is based on works being undertaken in accordance with the programme in terms of the baseline and Do Something year.

The assessment assumes good construction practice in place during construction as described in the Code of Construction Practice (CoCP) (see chapter 5.8).

It has been assumed that routine road runoff does not discharge to groundwater through the proposed attenuation ponds, as an impermeable lining will be included in the design.

The groundwater level baseline for the scheme was generally established over a three month monitoring period during autumn/winter 2010. The assumption has been made that the measured depths over this period will be representative of the water table beneath the route during the design year. Due to the wet weather typically experienced over this period, interpreted groundwater levels may be higher than typically experienced and therefore a conservative assessment having been made of potential impacts due to groundwater drawdown.

The Method C groundwater assessment assumes a worst case scenario that all runoff is discharged to ground.

All peak flows were calculated for the Q100 and include a 20% allowance to account for the effect of global climate change in accordance with current best practice.

All measures, including the environmental design, shall be carried forward into the detailed design.

12.6 Baseline Conditions

12.6.1 Surface Water Baseline Conditions

12.6.1.1 Catchment Topography and Hydrology

The study area falls within the North Eastern and the Neagh Bann River Basin Districts. Within these river basin districts the study area contains a number of watercourses.

The principal watercourses are Six Mile Water to the west, Larne River[78] to the north and Three Mile Water to the south, see **Drawing A8-S3-3456** and **Drawing A8-S3-3457 Appendix G1, ES Volume II.**

Minor tributaries to the Larne River include McCulloch's Burn, McRoberts' Burn and Glen Burn.

Six Mile Water flows in a predominantly north-east to south-west direction through the southern and central part of the scheme assessment area before ultimately discharging into Lough Neagh, which is the largest lake in the British Isles, located approximately 20km to the west of the study area.

Minor tributaries to the Six Mile Water include Ballynure Water, Ballylinny Burn, Ballymena Burn and Green Burn. Ballynure Water is formed at the confluence of Castle Water and Bryantang Water, located just to the east of the village of Ballynure. Ballynure Water flows east-west through the village to join Six Mile Water. Part of Ballynure Water within the village is within a Local Landscape Policy area and is defined as a local nature area. Upstream and downstream rivers are designated as salmonid waters, suggesting Ballynure Water is also important to salmonid species.

Three Mile Water flows in an east to west direction to the south of the scheme assessment area. Lisnalinchy Burn, a tributary of Three Mile Water itself is not within the scheme assessment area, however the catchment area for one of Lisnalinchy Burn's tributaries falls just within the area. The catchment for this watercourse overlaps the road scheme by a few hundred metres.

[78] The Larne River becomes the Inver River downstream, within the study area, but will be referred to as the Larne River for the remainder of this section, to avoid confusion.

12.6.1.2 Designated Sites

The Six Mile Water catchment is within the Neagh Bann International River Basin District (IRBD) while the Larne River catchment lies within the North Eastern International River Basin District. River Basin Management Plans were published in December 2009 and set out how objectives of the WFD are to be met over the plan period to 2015. The Management Plans are split into smaller management areas and the A8 sits within the Six Mile Water and the Larne Lough Local Management Area.

Six Mile Water is classified as a nutrient sensitive area under the Council Directive 91/271/EEC concerning urban waste water treatment (as amended) (UWWT Directive (consolidated)). The UWWT Directive seeks to protect water bodies from adverse effects of domestic sewage, industrial waste water and surface water runoff. It identifies water bodies that are eutrophic or which in the future may become eutrophic if preventative action is not taken.

The Six Mile Water, south of Ballyclare is designated as a nutrient sensitive area under the Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources (as amended) (the Nitrates Directive (consolidated)). The Nitrates Directive aims to prevent and reduce water pollution by nitrates from agricultural sources.

The Six Mile Water, the Larne River and Castle Water are designated Salmonid waters under Directive 2006/44/EC the Fish Directive (consolidated) ("FD"). The FD is concerned with the protection and improvement of fresh waters in order to support fish life. It sets water quality standards and monitoring requirements to ensure the protection of coarse and game fisheries. The Directive requires the designation of appropriate rivers and lakes into two categories of water: those suitable for Salmonids (game fish, mainly salmon and trout); and those suitable for Cyprinids (coarse fish).

All watercourses into which the A8 road drainage is proposed are either designated under the FD or eventually flows into the Six Mile Water or Larne/Inver River. They are therefore protected from contamination in line with the FFD limits.

12.6.1.3 Baseline Surface Water Quality Assessment

Since the publication of the draft Water Framework Directive (WFD) River Basin Plans in December 2008, GQA has been superseded by WFD classification.

Surface water quality monitoring carried out as part of the river basin management plans have identified the upper reaches of Six Mile Water as currently having 'Good' status while the lower reaches are described as heavily modified waterbodies and have been classified as having 'moderate ecological potential'. The Larne River has been classified as having 'Good' status.

Table 57 contains the current WFD classification of each watercourse, and the separate monitoring stations.

Table 57 **WFD Water Quality Classifications**

Monitoring Station	Monitoring stations number	Irish Grid Reference	Water body ID	Water Body Classification
Six Mile Water at Ballyboley Bridge	F10231	J315950	GBNI1NB030305202	Good
Castle Water at Castletown	F10228	J331938	GBNI1NB030305203	Moderate
Castle Water at Hillis Bridge	F10222	J312937	GBNI1NB030305203	Moderate
Six Mile Water below Ballyclare	F10238	J285903	GBNI1NB030305204	Moderate ecological potential
Green Burn at Millvale	F10223	J295909	GBNI1NB030305204	Moderate ecological potential
Ballylinny Burn at Milltown Bridge	F10221	J284900	GBNI1NB030305204	Moderate ecological potential
Lisnalinchy Burn at Ballywalter Bridge	F10230	J263883	GBNI1NB030305205	Moderate
Larne River at Ballyrickard Bridge	F10551	J367996	GBNI1NE040405047	Good
Larne River at Rock Filling Station	F10554	D390023	GBNI1NE040405047	Good
Larne River at Owens Bridge	F10555	D378009	GBNI1NE040405047	Good

The Larne River catchment is classified as having Good Status.

Prior to the use of the WFD Classification, NIEA WMU classified rivers using the Biological and Chemical GQA Scheme. Table 58 shows the recent historical classifications for those watercourses within the scheme area.

Table 58 **Chemical & Biological Classifications of Six Mile Water & Tributaries and Inver River, 04-07**

Sitecode	Location	Irish Grid Reference	GQA Chem 03-05	GQA Chem 04-06	GQA Chem 05-07
F10221	Ballylinny Burn at Milltown Bridge	J284900	N/A	N/A	N/A
F10222	[79]Castle Water at Hillis Bridge	J312937	B	B	B
F10223	Green Burn at Millvale	J295909	B	B	B
F10238	Six Mile Water below Ballyclare	J285903	B	B	B

[79] Castle Water is the Ballynure Water

Sitecode	Location	Irish Grid Reference	GQA Chem 03-05	GQA Chem 04-06		GQA Chem 05-07
F10551	Larne River at Ballyrickard Bridge	J367996	A	A		B
Sitecode	**Location**	**Irish Grid Reference**	**GQA Biol 2004**	**GQA Biol 2005**	**GQA Biol 2006**	**GQA Biol 2007**
F10221	Ballylinny Burn at Milltown Bridge	J284900	D	D	C	C
F10222	Castle Water at Hillis Bridge	J312937	C	D	D	D
F10223	Green Burn at Millvale	J295909	C	B	C	B
F10238	Six Mile Water below Ballyclare	J285903	B	C	C	C
F10551	Larne River at Ballyrickard Bridge	J367996	A	B	B	B

Classification: A: Very Good, B: Good, C: Fairly Good, D: Fair, E: Poor, F: Bad[80]

Because not all of the receiving watercourses are included in the NIEA water quality monitoring program, a programme of quarterly sampling were initiated in December 2009 to establish the chemical water quality of all of the receiving watercourses. The results of the sampling are presented in **Appendix G2, ES Volume II**. Due to the development of the design sampling has been included for watercourses no longer receiving discharges, and has excluded catchment 10a. However due to the low flow in this watercourse the assessment for the discharge considered the impact on groundwater, rather than surface water quality, in line with the HD 45/09. The lack of data for this watercourse has therefore not affected the assessment.

The sampling results showed that all the samples complied with the water quality standards with the exception of the following:

- Total ammonia exceeded the WQS in all surface waters during all sampling events;
- Nitrite exceeded the WQS in all surface waters during all sampling events;
- Total petroleum hydrocarbon compounds were detected at slightly elevated levels in two of the surface waters in March and June 2010; and
- Suspended solids exceeded the WQS in one surface water sample taken in June 2010.

12.6.1.4 Baseline Surface Water Flows

The catchment area for the scheme covers approximately 106.85km^2 upstream of the assessment area. The Q95 for the watercourses receiving surface water discharges was determined using LowFlows software while the remaining

[80] Historical data obtained by request from NI Environment Agency. River monitoring results for 2003-2007 are available at http://www.ni-environment.gov.uk/water/quality/rivers/river_results.htm

receiving watercourses were estimated rescaling the catchment sizes and Q95 flows for the known receiving watercourses. The defined catchment areas and Q95 for each outfall location are shown in Table 59. Outfall locations are described in chapter 12.7.3.

Table 59 **Defined Catchment Area and Q95 Flows**

Outfall	Watercourse	Defined Catchment Area (km^2)	Q95 (m^3/s)
1	Ballylinny Burn tributary	0.39	0.001
4	Ballymena Burn tributary 1	2.4	0.007
5	Ballymena Burn tributary 3	0.88	0.003
6	Green Burn	1.5	0.003
7	Ballynure Water	22.65	0.068
8	Ballynure Water	22.65	0.068
9	Six Mile tributary 1	1.1	0.003
10	Six Mile tributary 2	0.83	0.003
10a	Larne River tributary 1	0.33	0.001
13	Larne River tributary 2	1.24	0.004
15	Larne River tributary 3	12.87	0.037
16	Larne River	12.87	0.037
17	Larne River tributary 4	0.38	0.001
18	Glen Burn	5.93	0.019
19	Larne River tributary 4	3.62	0.011

12.6.2 Baseline Surface Water Peak Flows

25 specific sub-catchments were selected based on their contributions within the Six Mile Water and Inver River catchments. The Q100 peak flows determined for each reach using both the FEH Statistical Method and the Revitalised FEH/FSR Rainfall Run-Off method are shown in Table 60.

Table 60 **Q100 Peak Flows for Six Mile Water and Inver River Catchments and their Sub Catchments**.

River Reach	Contributing Catchment Area (km^2)	QMED at Subject Site (m^3/s)	Q100 Peak Flow (m^3/s)	
			FEH Statistical Method	Revitalised FEH/FSR Rainfall Run-Off Method
Ballylinny Burn	5.76	N/A	-	
Unknown	0.51	0.25	0.83	0.96

River Reach	Contributing Catchment Area (km²)	QMED at Subject Site (m³/s)	Q100 Peak Flow (m³/s)	
			FEH Statistical Method	Revitalised FEH/FSR Rainfall Run-Off Method
Ballylinny Burn	5.01	1.72	5.67	6.24
Ballymena Burn	4.61	N/A	-	
Unknown	3.39	N/A	-	
Unknown	2.4	2.21	7.15	4.32
Unknown	0.78	0.64	2.12	1.68
Ballymena Burn	0.97	1.21	3.93	2.16
Green Burn	2.04	1.94	6.32	3.96
Six Mile Water	36.02	16.81	40.99	50.64
Ballynure Water	22.57	11.01	28.54	29.88
Unknown	0.94	0.44	1.42	1.68
Ballynure Water	21.53	N/A	-	
Unknown	1.27	0.67	2.1	2.16
Ballynure Water	19.71	8.89	23.63	26.64
Bryantang Water	9.54	4.07	11.96	12.72
Castle Water	9.42	6.86	20.75	14.40
Six Mile Water	12.25	N/A	22.1	
Inver River	22.53	N/A	38.34	
Glen Burn	5.46	5.82	17.34	13.44
Inver River	16.9	N/A	21.00	
Mc Roberts' Burn	3.11	N/A	6.90	
Larne River	6.21	2.14	6.54	9.36
Larne River	2.17	N/A	5.16	
Unknown	1.85	0.83	2.81	3.00
Unknown	2.86	N/A	3.68	
Ballylinny Burn	1.89	N/A	2.57	

12.6.3 Baseline Groundwater Conditions

The landscape traversed by the A8, is a broad open valley between the line of hills to the north of Belfast, which mark the edge of the Antrim Plateau, and a more extensive area of upland further north which comprises the main part of the Antrim Plateau. This valley feature approximately follows a major fault line – the Six Mile Water Fault – and at its north-eastern end is occupied by stream courses draining towards Larne, whilst the central part is occupied by the course of the Six Mile Water draining westwards into Lough Neagh.

The elevation of the A8 rises again to 140m Above Ordnance Datum (AOD) at Coleman's Corner and falls to approximately 105m AOD at Ballynure. The elevation of the A8 north-east of Ballynure is 130m AOD and falls to approximately 90m AOD at the Larne end of the scheme.

The ground conditions beneath the scheme assessment area are described in chapter 11 'Geology and Soils'. Ground conditions typically comprise up to approximately 5m of glacial till overlying basalt bedrock, with localised areas of soft alluvium and peat present from the ground surface at some locations, typically within hollows in the landscape, and adjacent to watercourses.

Permeability recorded from in-situ tests generally indicate that both the glacial till that makes up the majority of the superficial deposits, and the underlying bedrock, are of a low to very low permeability of similar orders of magnitude. The details and results of the permeability tests are presented in **Appendix G3, ES Volume II**.

The permeabilities recorded for the bedrock were generally less than those recorded for the glacial till. However, the mass permeability of such bedrock is generally controlled by secondary permeability through discontinuities in the rock mass (Thompson 1997). As the in-situ permeability tests were carried out over a relatively small area of bedrock – corresponding to borehole response zones of less than 1m in length – and therefore over areas with limited discontinuities, it is anticipated that the mass permeability of the bedrock over wider areas may be significantly higher. This view corresponds to the published geology for the area, which suggests that along the Six Mile Water valley the basalt is likely to be well jointed and fractured by the Six Mile Water Fault and carry much water (Thompson 1997).

12.6.3.1 Groundwater Vulnerability

Groundwater vulnerability map of Northern Ireland[81] identifies the vulnerability of groundwater to contamination. It is based on the distribution of aquifers, characteristics of strata in the unsaturated zone, and physico-chemical characteristics of overlying soils. It indicates the risk posed to groundwater from surface activities by categorising ground conditions into seven vulnerability classes.

The map indicates "low permeability, non-water bearing drift deposits" to be present along the majority of the proposed scheme. It states that such deposits may comprise peat, recent lacustrine deposits or till. However, the spatial

[81] (Department of the Environment for Northern Ireland 1994a)

distribution correlates well with areas that are underlain predominantly by glacial till which has been proven to some depth.

The map indicates that the site overlies Type B bedrock which coincides with the distribution of basalt bedrock. Type B bedrocks are described as “fractured or potentially fractured rocks which do not have a high primary permeability. These aquifers will seldom produce large quantities of water for abstraction”.

The map also indicates that the soils overlying the Type B bedrock are of intermediate and low leaching potential. Soils of intermediate leaching potential are soils that have a moderate ability to attenuate, adsorb or transmit contaminants. Soils of low leaching potential are soils that have are unlikely to attenuate, adsorb or transmit contaminants. The soils defined as having low leaching potential are predominantly situated to the south of Ballynure, whereas soils defined as having intermediate leaching potential are situated to the north of Ballynure.

12.6.3.2 Hydrogeology

The hydrogeological map of Northern Ireland[82] provides information on annual average rainfall and groundwater flows in aquifers, surface water and groundwater features within Northern Ireland. The entire site is shown to be underlain by a basalt aquifer of the Upper and Lower Basalt Formation. This is classified as a locally important aquifer in which the flow is dominantly in fissures and discontinuities.

Hydraulic conductivity within the Lower Basalt Formation is stated as varying from low to moderate, with some primary conductivity in the weathered horizons, but principally secondary development of joints and other fissures. Groundwater within this aquifer is said to be of the calcium-bicarbonate type, weakly to moderately mineralised containing 80 to 150mg/l alkalinity.

12.6.3.3 Groundwater Levels

Ground investigations were undertaken between 2008 and 2010 to establish the groundwater levels along the route. The groundwater monitoring locations of the preliminary and main ground investigations are presented on **Drawing A8-S3-3401-3403**, **Appendix G4, ES Volume II.**

During the preliminary ground investigation, groundwater monitoring installations were installed in five boreholes and in 25 boreholes during the main ground investigation. Groundwater monitoring installations comprised both standpipes and Casagrande piezometers, dependent on the ground conditions encountered. Response zones were installed within both the superficial deposits and the basalt bedrock, details are summarised in **Appendix G5, ES Volume II**.

Recorded piezometric levels in the superficial deposits are generally very similar to those recorded in the bedrock throughout the route, with differences typically up to a maximum of approximately 0.5m. In BH107 and BH127, despite variations in overall piezometric level over the monitoring period, recorded levels within the superficial deposits did not vary by more than 0.01m from those in the

[82] (Department of the Environment for Northern Ireland 1994b)

bedrock at any one time. This indicates that the two strata are likely to be in hydraulic continuity at these locations.

The results of the groundwater monitoring carried out indicate that piezometric levels typically lie at shallow depths across the entire route. Within the south of the route, piezometric levels typically correspond to depths of less than 2.0m below ground level (bgl). Where the proposed vertical alignment drops down along the valley side for the proposed bypass west of Ballynure, piezometric levels typically correspond to greater depths, generally of between 2m bgl and 5m bgl. In the north of the route, piezometric levels are generally at their shallowest depths, with the peizometric surface rarely deeper than 2m bgl and typically less than 1m bgl.

Results from installations in the superficial deposits and the bedrock in BH102 and BH105 vary by up to 2.6m. The biggest variation is shown to be in the winter months, where piezometric levels within the bedrock rise relative to those in the superficial deposits, before reducing to levels below those of the superficial deposits during the spring months. Therefore, at some locations along the route the basalt bedrock may be acting as a confined aquifer during wetter months of the year. This is likely to be a result of a relatively lower permeability of the glacial till resulting in piezometric levels taking some time to equilibriate to increased water pressures applied from the underlying bedrock during periods of wet weather.

12.6.3.4 Groundwater Quality

Surface waters and groundwaters in Northern Ireland are monitored by the NIEA WMU to make sure that they comply with current standards and regulations. For groundwater quality only two standards - good / poor - have been adopted. It is the NIEA's policy to ensure that it achieves a standard of 'good' for all designated groundwaters. This is implemented through the production of river basin management plans which are in place for the area, with associated programmes of monitoring for groundwater bodies.

The NIEA have classified all groundwater bodies within the scheme assessment area as having a ‘good’ quantitative and chemical status.

The locations of all NIEA groundwater quality monitoring wells are presented on **Drawing A8-S3-3401-3403**, **Appendix G6, ES Volume II.** Groundwater quality test results provided by NIEA for a location to the south-east of the proposed scheme are provided in **Appendix G7, ES Volume II**. Results indicate that levels of phosphorous exceed the UKDWS. Phosphorus is a nutrient and levels may be naturally high, therefore the high levels recorded do not necessarily indicate that contamination is present.

As part of the main ground investigation, a programme of groundwater sampling and testing was undertaken from April to June 2010. During this period, samples were taken on a monthly basis from six borehole installations that were installed during the main ground investigation. The borehole installations adjacent to locations where outfalls were being considered for the proposed scheme were selected for sampling and testing, these were BH102, BH108, BH122, BH123, BH124, BH125.

Samples were tested for a range of organic, inorganic, metal and non-metal contaminants assessed as potentially being present on the basis of the findings of previous desk study and ground investigation work. The groundwater quality results are summarised in **Appendix G8, ES Volume II**.

The groundwater test results indicate little evidence of groundwater contamination. Contaminants were mainly detected in BH108, which recorded concentrations of Benzo[k]flouranthene, Indeno[1,2,3-cd]pyrene and Benzo[g,h,i]perylene that exceeded Environmental Quality Standard (EQS) guidelines. Concentrations of Flouranthene also exceeded UKDWS.

Recorded pH values in BH102, BH108, BH123 and BH124 were all marginally higher than that recommended by the EQS guidelines, this may be as a result of the calcium-bicarbonate nature of the groundwater from the basalt aquifer.

The existing A8 currently has over-the-edge drainage, with little control of any pollution that may be generated from the road. Therefore, in its current form there is potential for contamination from road runoff and accidental spillage to be discharged to groundwater.

12.6.3.5 Existing Abstractions

From discussions with NIEA WMU, Newtownabbey and Larne Borough Councils, information has been provided regarding abstraction licences for public and private supply, historic abstractions and abstraction licence applications. These are tabulated in **Appendix G9, ES Volume II** and presented on **Drawing A8-S3-3404 to A8-S3-3405**, **Appendix G6, ES Volume II**, which also presents the location of wells identified through a review of historical information.

12.6.4 Baseline Accidental Spillage Conditions

The NIEA produce an annual report (Northern Ireland Environment Agency Water Management Unit 2009) which details statistics relating to water pollution incidents throughout Northern Ireland.

Table 61 and 62 detail pollution incidents occurring in Region 3, the area in which the proposed A8 Dualling is located.

Table 61 **Pollution Incidents for Region 3 by Year and Severity 2003 - 2009**

Region 3	**Severity**			
Year	**Low**	**Medium**	**High**	**Total**
2003	122	30	5	**157**
2004	117	33	4	**154**
2005	124	14	1	**139**
2006	117	28	4	**149**
2007	158	23	0	**181**
2008	121	31	2	**154**
2009	129	25	1	**155**

Table 62 **Distribution of Region 3 Pollution Incidents 2003 - 2009**

Year	Industry	Farm	Water Service	Domestic	Transport	Other	Total
2003	39	38	32	20	7	21	**157**
2004	52	37	24	13	9	19	**154**
2005	33	30	20	23	9	24	**139**
2006	49	32	25	11	10	22	**149**
2007	35	36	36	39	3	32	**181**
2008	36	36	26	24	4	28	**154**
2009	29	31	37	27	3	28	**155**
Total	**273**	**240**	**200**	**157**	**45**	**174**	**1089**

For region 3, the total number of pollution incidents in 2009 is relatively similar to that of preceding years (see Table 61).

Over the 6 years preceding 2009 there has been a general decrease in the number of incidents from transport sources, whereas the number of incidents from industrial, farm, water and domestic sources has remained relatively similar. Transport is shown to be responsible for only 1.9% of pollution incidents, whereas the remaining sources account for approximately 20% each (see Table 62).

In terms of pollution recorded as having caused fish kills, transport in Northern Ireland has been responsible for 3 pollution incidents since 2003, accounting for just 1.6% of the total (see Table 63).

Table 63 **Trends in Pollution Causing Fish Kills 2003 - 2009**

Source	2003	2004	2005	2006	2007	2008	2009	Total
Farm	8	9	5	3	7	9	7	**76**
Water Service	6	1	1	2	2	6	1	**34**
Industry	6	4	2	7	2	2	7	**39**
Domestic	3	3	2	6	3	5	1	**31**
Other	0	1	0	0	1	0	0	**2**
Transport	1	0	0	1	0	0	1	**3**
Total	**24**	**18**	**10**	**19**	**15**	**22**	**17**	**185**

12.6.5 Baseline Flood Risk Conditions

The HEC-RAS hydraulic model was run to produce an assessment of the flood plain. The results of this assessment are provided in **Appendix G10, ES Volume II**.

The A8 currently crosses two major river catchments. The southern section lies within the catchment of the Six Mile Water and the remainder of the scheme lies within that of the Larne River.

Six Mile Water Catchment

The Six Mile Water runs southward to the west of the proposed scheme. The closest that it lies to the proposed highway footprint is 200m on the Ballynure by-pass section. The highway footprint does not encroach on the Six Mile Water flood plain. This proposed scheme crosses eleven significant watercourses, nine of which are to be culverted. Of the remainder, catchment two passes under the Ballylinny Burn underbridge and catchment seven under the Ballynure Water, Church Road underbridge.

Most of the watercourses crossed by the proposed route south of the Ballynure Water, Church Road underbridge form complex combined catchments which eventually pass through the town of Ballyclare. This section of the proposed scheme is largely online. Existing culvert under are generally undersized, in relation to the current standards, and act as constraints to high flows, causing localised upstream flooding under high flow conditions. These constraint problems do not arise in the case of the two bridges on this section.

The Larne River Catchment

The Larne River runs north-eastward generally parallel to the proposed scheme. It predominantly lies on the eastern side of the scheme but there are sections to the west. There are some sections where the highway footprint marginally encroaches on the flood plain. At the downstream end, within the catchment area, the river becomes the Inver River.

This section of the highway is crossed by 12 significant watercourses eight of which are to be culverted. Four of these crossings are of the Larne River, two of which are culverted while catchments 15 and 16 pass under the Stewartstown and Bogtown underbridges respectively.

Of the non Larne River crossings catchments 18 and 19 pass under the Lowtown underbridge and Gingles Corner underbridge/cattle underpass respectively.

The constraint problems on Six Mile Water catchment mentioned above are not considered to arise on this section. .

Structures

There are several existing structures that potentially affect the flow in the Six Mile Water including the Hillis Bridge over Ballynure Water, together with some minor bridges over the Six Mile Water upstream of the confluence with the Ballynure Water. However, the highway footprint does not encroach on the Six Mile Water flood plain

The Stewartstown and Bogtown underbridges mentioned above do not potentially affect the flow in the Larne River but others that could include the Ballygowen Road bridges over the Larne River and the Lowtown underbridge and Gringles Corner underbridge/ Cattle underpass.

12.6.6 Geomorphology Baseline Conditions

Seven sites were considered during the geomorphology study. Further details are presented in full in Appendix L.

Site 1 - Chainage 3+000m and Site 3 - Chainage 10+100m

Sites 1 and 3 are field drain features, rather than fluvial water courses. The geomorphologic qualities of these sites were limited and they were therefore not assessed further.

Site 2 – Chainage 5+600

Upstream of Hillis Bridge (a masonry arch road bridge) the channel is approximately 4m wide and 0.5m deep. It has a good level of hydraulic and morphological diversity and vegetation was found to be dense. However much of the southern bank has been artificially protected with large cobbles and boulders. Downstream of the bridge, the channel widened significantly to approximately 8m, with a variable depth of between 0.2 to 0.4m. There was much localised hydraulic diversity in this reach and bank erosion features were present in this reach. Overall the river appeared to be geomorphologically stable upstream of Hillis Bridge, and more unstable downstream of the bridge. This is most likely due to the impact of the existing bridge structure in controlling bed levels upstream.

Site 4 – Chainage 12+000

This site is south of the Loughside Quarry, to the east of the existing A8 road. The Larne River at this site is has natural and modified stretches. The natural section upstream of the quarry flows through rough pastoral farmland and has been identified as being of good quality and as being a sensitive receptor to any local changes.

The downstream section consists of a modified and engineered section of approximately 50m in length, which leads the river around the quarry. The river then follows a straight course to the west of the quarry until it rejoins a natural section downstream. This section is largely in poor geomorphological condition.

Site 5 – Chainage 12+500

The River Larne at site 5 has been modified to follow a direct route between the existing A8 road embankment and a disused railway embankment. The straightened section of river consists of a long glide feature, with a fine/sandy bed and offers little geomorphological diversity and is therefore considered to be in a poor geomorphological condition. The railway embankment acts as a barrier between this new river course and a dry/relict meandering section of channel which is located in the field to the east. The existing realigned section of channel is approximately 200m long between the culvert under the existing A8, and a more sinuous/natural section to the south. The straightened section has some geomorphological diversity as it bends to pass under the A8, where a large pool has formed. Anecdotal evidence from local fishermen suggests that this pool supports a good fish population.

The original meandering channel has remained as a relict feature on the floodplain adjacent to the current channel, and offers an insight into historical natural conditions.

The more natural section to the south of the straightened modified section showed relatively high levels of geomorphological diversity, with a range of hydraulic features being found every 10m or so over the 100m reach.

The natural section upstream of the straightened section has been identified as being of good quality and as being a sensitive receptor to any local changes.

Site 6 – Chainage 12+900

The river to the east, upstream of the A8, flows through quite a steep pastoral field into a large culvert which takes the flow under the existing A8. This section of river, up to Park Road is around 100m in length. The steep, relatively high-energy channel contains many boulder bed features and energetic flow units such as runs, rapids and glides with slower moving glides in between. This pattern of features presents a very diverse environment sedimentologically and hydraulically.

Immediately to the east, downstream, of the A8, the river remains similar to the upstream section morphologically for around 40m, although it has a lower gradient. A high, steep embankment which is heavily vegetated with trees and grasses is situated immediately south of the channel. Intermittent patches of mild fluvial bank erosion were present over this reach. This would indicate active meander processes which in time may reduce the gradient and energy distribution of this reach as sinuosity increases.

Site 7 – Chainage 13+800

The Glen Burn watercourse flows between a residential plot and an arable field containing grasses upstream of the A8. Downstream of the A8 the river flows through grassland on both sides, with a heavily vegetated riparian zone consisting of trees and shrubs. The channel is relatively steep and has a bed consisting of cobble-boulder sized sediments, suggesting that the river encounters high and flashy flows on a fairly regular basis.

12.7 Environmental Design

As detailed within chapter 5.3.1, the A8 Dualling scheme has progressed with continuous collaboration between the design team and environmental specialists. Through this process, an environmental design has been developed as an integral part of the overall scheme design. These measures have been assessed as part of the scheme and are not considered to be additional mitigation measures.

The ‘Do Something’ scenario represents the proposed scheme drainage strategy and the watercourses it discharges to. Routine road runoff will be collected, channelled through petrol interceptors and discharged at discrete outfall locations at positions of existing watercourses, at regular intervals along the route. Further details of the proposed scheme are provided in chapter 5, an overview is provided below.

12.7.1 Traffic Density

The two way AADT flows for both the ‘Do Minimum’ and the ‘Do Something’ scenarios are predicted to be within the range 15,000 to 30,000 trips, as set in the HAWRAT tool for the purpose of the water quality assessment. See **Appendix G18, ES Volume II** for detailed AADT figures for individual road sections.

12.7.2 Highway Drainage

12.7.2.1 Surface Water and Subsoil Drainage

The preliminary design includes a positive surface water drainage system (channels, kerb and gullies, or combined kerb drainage units) for the mainline and side roads. The preliminary design is based on most of the scheme being kerbed with surface water drained by gullies with sealed carrier drains or by combined kerb and drainage block systems. The latter will be used on on-line sections where lowering the highway to facilitate construction and traffic management would preclude the gully/sealed carrier drain option. The section of the scheme bypassing Ballynure will not be kerbed and here surface water will be drained by concrete Surface Water Channels (SWC) or Grass Surface Water channel (GSWC). The choice between SWC or GSWC is to be determined at detailed design. The drawbacks to GSWC are that wider verges are required which may lead to undesired parking,

It is proposed to include petrol interceptions on all discharges to surface waters. Currently surface water runoff is not treated by petrol interceptors. This will improve the quality of water being discharged along the route. Subsoil drainage would be by means of narrow filter or fin drains.

12.7.2.2 Cross Drainage

The cross drainage proposals for the scheme have been assessed based on a 1 in 100 year flood run off calculated in accordance with HA 106/04 with an additional allowance of 20% for global warming; see **Appendix G11, ES Volume II**.

Many of the existing cross-drainage structures will be replaced as part of the proposed scheme. Current highway standards will result in larger capacity structures in some cases where the existing structures constrict the flows.

Culvert design has been undertaken using the Bentley Systems Program "CulvertMaster" supplemented by the HEC-RAS river analysis system program. HEC-RAS has also been used to model the watercourses.

12.7.2.3 Attenuation

Areas for attenuation have been identified in the scheme design for all drainage outfalls, if required.

Attenuation assessments have been carried out on all receiving watercourses to confirm the need for attenuation of the surface water and that the discharge of the design drainage system will not make the present situation any worse in terms of flooding. The assessments have been completed for both surface water flows and subsoil drainage. The results of these assessments are summarised in an Attenuation Report, which is included in **Appendix G12, ES Volume II**.

The report has identified that of the 17 proposed outfalls for the scheme, no attenuation is necessary for Outfalls 7, 8, 13, 14, 15, 16, 17, 18 and 19. Attenuation will be required for Outfalls 1, 4, 5, 6, 9, 10 and 10A.

For the locations where attenuation would be required, attenuation ponds will be provided which will be designed to cater for 1 in 100 year storm events + 20% climate change, whilst limiting the flows to a greenfield run off rate of 10 l/s per ha subject to a minimum flow of 15 l/s. An overflow system to deal with a rainfall event in excess of the 1 in 100 year storm would be included.

For locations that are currently identified as not requiring attenuation, the areas for the attenuation pond identified within the scheme design will be retained, in the event detailed design results in a change to the flood risk due to changes in areas of hard standing draining to outfalls.

12.7.3 River and Stream Outfalls

The surface water and sub soil drainage from the A8 will discharge through 15 outfalls into the nearby watercourses, see Table 64. Of these, eight eventually reach the Six Mile Water and flow through Ballyclare with the remaining seven reaching the Larne River.

Table 64 **Outfalls to surface watercourses**

Receiving catchment	Watercourse name	Outfall name*
1	Ballylinny Burn	1
4	Ballymena Burn Tributary 1	4
5	Ballymena Burn Tributary 2+3	5
6	Green Burn	6
8	Ballynure Water	7
8	Ballynure Water	8
9	Six Mile Tributary 1	9
10	Six Mile Tributary 2	10
10a	River Larne Tributary 1	10a
13	River Larne Tributary 2	13
15	Larne River	15
16	Larne River	16
17	River Larne Tributary 4	17
18	Glen Burn	18
19	Larne River Tributary 5	19

*Outfalls are named after the recieving watercourse, with the exception of outfall 7.

It must be noted that the specific outfall locations are not finalised and could be altered slightly during the detailed design.

Surface water from side roads and link roads that does not drain to the mainline drainage has not been assessed. This consists of a number of relatively small areas, and where these are on the line of the existing side roads they are similar to the existing situation. It is therefore considered that drainage from these areas will not result in significant effects on the water environment.

12.7.4 River and Stream Realignments

The proposed scheme will result in major stream re-alignments at five locations due to the construction of road junctions, the need to increase the footprint of the road and the construction of off-line sections of road. The new alignments are described in Table 65 and layout drawings are provided in **Appendix G13, ES Volume II**.

Table 65 **River and Stream realignments**

Location	Chainage	Details
Church Road	Ch 5+500 to 5+600	Ballynure Water currently passes under Church Road at Hillis Bridge. Upstream of Hillis Bridge the existing meander will be moved to the north, to provide the footprint required for a new embankment, see Drawing WD_001_ in Appendix G13, ES Volume II. The new river channel will be approximately 80m long. Existing bed material will be translocated to the new channel and bank protection provided along Church Road and riffles installed, using fixed logs, if necessary, to provide stability.
Deerpark Road Junction	Chainage 11+900 to 12+100	The existing Larne River channel currently passes around the quarry site and runs parallel to the A8. The new river would be rerouted around the proposed road filter layout, before connecting with the existing channel near to chainage 12025m. See Drawing WD_002_ in Appendix G13, ES Volume II. The new river channel will be approximately 140m long. The new channel will have increased sinuosity and be profiled to replicate a natural pool-riffle sequence (pool run in straighter sections). Variability in bed sediment will be implemented accordingly (relatively coarse sediments on riffles and relatively fine sediments in pools). This coarse sediment may need to be imported from off site. Upstream and downstream riffle features could be stabilised using pinned logs.
South of Stewartstown Drive	Chainage 12+300 to 12+600	The existing River Larne runs parallel to the A8 road, and has been straightened historically. The new river would be situated south of this to allow for the widened proposed A8 road. A relict (cut off) meander scroll would be connected to reinstate historical conditions pre-modification. See Drawing WD_003_ in Appendix G13, ES Volume II. The new river channel will be approximate 300m long. The new channel will have increased sinuosity and be profiled to replicate a natural pool-riffle sequence (pool run in straighter sections). Variability in bed sediment will be implemented accordingly (relatively coarse sediments on riffles and relatively fine sediments in pools). This coarse sediment may need to be imported from off site. Upstream and downstream riffle features could be stabilised using pinned logs. Potential small backwater downstream (north) of the A8 using old channel. The re-connected meander should be profiled accordingly before flows are redirected down the channel.
North of Stewartstown Drive	Chainage 12+900 to 13+000	The existing channel flows west to east and is fairly steep upstream of the A8, and runs close to a steep embankment to east of the reach downstream of the A8.

Location	Chainage	Details
		The proposed channel would head through a new culvert about 30m to the north east on the A8. See Drawing WD_004_ in Appendix G13, ES Volume II. The new river channel will be approximately 100m long. Existing bed material (boulders and gravels) will be translocated to the new channel.
Glenburn	Chainage 13+800	The existing channel flows in a fairly straight line north to south. The proposed channel would take a more sinuous route through a new culvert which would be located around 30m to the east. See Drawing WD_005_ in Appendix G13, ES Volume II. The new river channel will be approximate 120m long. Existing bed material (boulders and gravels) will be translocated to the new channel. Potential small back water downstream of the A8 using old channel.

12.8 Assessment of Effects due to Construction

The assessment of the effects upon the water environment considers and compares two scenarios:

- The existing 'baseline' situation; for the purposes of this assessment AADT traffic figures for 2008 have been used; and
- The 'Do Something' scenario for the design year, including the A8 Dualling scheme and environmental design measures, AADT traffic figures for the design year 2031 (15 years after opening) have been used in the assessment.

A Do Minimum scenario consisting of the likely changes anticipated in the absence of the A8 Dualling is considered to be equivalent to the baseline criteria in the case of the water environment.

Construction phase effects are considered to include those resulting from demolition and potential re-use of parts of the existing A8 and construction of new sections of the road and drainage systems.

12.8.1 Identification of Construction Effects

There are many risks that will be required to be controlled to minimise the potential for adverse environmental effects. Potential effects identified are described in Table 66.

Table 66 **Potential Adverse Environmental Effects**

General Issue	Potential Effect	Receptor
Surface Water	Disturbance of silt/soil generating surface runoff with high sediment loading (mobilised suspended solids), during works adjacent and within channels.	All watercourses
	Accidental spillage of fuels, oils, chemicals and materials (e.g. concrete, plant fuels/oils, lubricants, hydraulic fluids and floating solids such as litter).	All watercourses
	Dewatering of excavations and discharge of high suspended solid content to receiving watercourses.	All watercourses
	Direct in-channel impacts arising from works undertaken for river realignments and to upgrade or create crossing points of watercourses.	All watercourses
Surface Water Flow	Unregulated and poorly designed discharges resulting in significant variation to the natural flow regime of the receiving watercourses.	All watercourses
Aquatic Ecology	Pollution incidence resulting in fish kills.	All watercourses
	Siltation of salmonid spawning beds due to siltation.	All watercourses
Groundwater Levels	Dewatering of cuttings may result in a drawdown of the groundwater table, reducing the yield of existing abstractions.	Groundwater abstraction points
	Dewatering of cuttings may result in a drawdown of the groundwater table, resulting in reduced flows to springs and rises, and reduced recharge/supply to existing surface watercourses.	Surface water features
	Increased flow through watercourses as a result of increased discharge from outfalls due to the drawdown of groundwater levels within cuttings.	Existing watercourses
Groundwater Quality	Reworking of previously contaminated land during construction may result in leaching of contaminants to groundwater.	Groundwater
	Contamination to groundwater as a result of accidental spillage of fuels, oils, chemicals and other materials during construction.	Groundwater
Flooding	Increased risk of localised flooding. Loss of flood plain capacity e.g. due to temporary storage areas.	Flood Plain
	Increased risk of erosion or scouring and flooding in the catchment due to the alteration of natural drainage patterns (i.e. artificial concentration and obstruction of overland flows).	Flood Plain

12.8.2 Significance of Construction Effects

The assessment of the environmental effects during the construction phase is presented in Table 67.

Table 67 **Significance of Effects on the Water Environment during the Construction Phase**

Feature	**Quality Indicator**	**Quality**	**Importance / Sensitivity of Receptor**	**Potential Effects**	**Magnitude**	**Significance**
Surface Watercourse	Water Quality	Status 'Good'	High	Pollution from spillages resulting in reduction in surface water quality	Minor Adverse, Direct/ Indirect Temporary	Moderate Adverse
Surface Watercourse	Water Quality	Status 'Moderate Ecological Potential'	Medium	Pollution from spillages resulting in reduction in surface water quality	Minor Adverse, Direct/ Indirect Temporary	Slight
Surface Watercourse	Fisheries Quality	Salmonid watercourse	Very High	Pollution from spillages resulting in reduction in surface water quality	Moderate Adverse, Direct/ Indirect Temporary	Large Adverse
Surface Watercourse	Water Quality	Status 'Good'	High	High silt levels in the channel downstream of in channel works.	Minor Adverse, Direct/ Indirect Temporary	Moderate Adverse
Surface Watercourse	Water Quality	Status 'Moderate Ecological Potential'	Medium	High silt levels in the channel downstream of in channel works.	Minor Adverse, Direct/ Indirect Temporary	Neutral
Surface Watercourse	Fisheries Quality	Salmonid watercourse	Very High	Impact on fisheries spawning grounds due to high silt levels in the water, downstream of in channel works.	Moderate Adverse, Direct/ Indirect Temporary	Large Adverse
Surface Watercourse	Water supply/ quality	Baseline flows range between 0.001 to $0.07m^3/s$	High	Drawdown of water table reduces future recharge / supply of watercourses	Negligible See Appendix G14 ES Volume II	Neutral
Surface Watercourse	Flow in watercourses	Baseline flows range between 0.001 to $0.07m^3/s$	High	Additional discharge at outfall locations increases flow levels	Negligible See Appendix G14 ES Volume II	Neutral

Feature	Quality Indicator	Quality	Importance / Sensitivity of Receptor	Potential Effects	Magnitude	Significance
Flood plain	Conveyance of flows	Local	Low probability of flooding properties	Low: scheme unlikely to result in significant impediment of the flood plain	Minor Adverse, Temporary	Neutral
Groundwater	Yield	Currently yields sufficient water for general agricultural use	Medium	Drawdown of water table prevents future abstraction	Negligible; see Appendix G14, ES Volume II.	Neutral
Groundwater	Groundwater quality	Status 'Good'	Medium	Pollution from spillages resulting in reduction in groundwater quality	Minor Adverse, Direct, Permanent	Slight

The majority of potential effects due to construction are assessed to be neutral. However, adverse impacts are identified on surface water quality and surface water flows due to draw down of groundwater, and on surface water fisheries. Because of different water quality between different stretches of river, the effects on water quality differ. However for the purpose of the assessment the more significant effects are considered.

The effect on water quality is identified as ***moderate adverse***. The receptor sensitivity is high, due to the good water quality status and the moderate adverse impact. The effects are predicted to arise due to in channel works and may also arise due to accidental spillages.

The effect of construction on the surface water fisheries quality is predicted to be ***large adverse*** due to the fact the receiving watercourses are designated under the FD as salmonid watercourses and the impact of a pollution event may result to a partial loss of the production of the catchment wide fishery. These effects are predicted to arise due to in channel works and may also arise due to accidental spillages.

The potential effect on groundwater, due to pollution from spillages, is considered to ***slight adverse***. The sensitivity of the groundwater is considered to be medium, as while it does provide some local water supply it is not considered to be a principle aquifer, and the magnitude of any spillages is likely to be minor adverse.

12.9 Mitigation of Effects due to Construction

This section identifies mitigation measures where adverse effects due to construction have been identified.

The effects due to construction are on both surface water and groundwater and would be due both to pollution from spillages, which may or may not occur, and from high silt levels in the watercourse downstream of in channel works, such as the construction of river diversions and installation of culverts.

The works within the channel, together with any works that may affect the watercourses will require consent from the Rivers Agency, under the terms of Schedule 6 of the Drainage (NI) Order 1973.

A CoCP, outlined in chapter 5.8 of this ES, will be used to reduce the risk of accidental spillages and pollution. This includes mitigation to reduce the risk of pollution to the water environment in line with the relevant Pollution Prevention Guidelines (PPGs), including spillages to the surface water and ground water, containment of fuel and control of silt in surface water runoff. The CoCP will be further developed by the Contractor to include further site specific and working method specific risk reduction measures.

The likelihood of the spillage risks will therefore be greatly reduced through the use of the CoCP and for the purpose of the assessment methodology the magnitude of the effect can therefore be considered to be reduced.

Impacts due to in channel work will be reduced though the use of site specific method statements for each piece of in channel works. The method statement will include an environmental risk assessment specific to the detailed design and will identify working methods to reduce and mitigate the effects.

Working methods use to limit the quantity of silt entrained in the water column are likely to include off line construction of new channels, the use of coffer dams and over pumping and downstream silt barriers, such as stilling pools to settle out high silt loads and sediment screens. In addition the work should be programmed during periods of low flow, to reduce the scouring effect and volume and volume of water affected and to enable the majority of the flow to be over pumped, where feasible.

12.10 Residual Effects due to Construction

The implementation of a CoCP is considered to reduce the magnitude of the effects to a minor magnitude. While the use of the CoCP should remove the risk of accidents to a negligible level it is considered that as there is still a small residual risk and so must be considered to be a minor adverse impact.

The adverse effects due to the increased silt load in the water, due to in channel works, will still result in high silt loading but this will only be on a very local level, and it therefore also considered to have a minor adverse impact.

Therefore in terms of the effect to the surface water quality the effect can therefore be considered to be ***slight/moderate adverse***. However it should be noted that this effect will only be in the instance of a spillage or pollution incident, and is therefore not definite.

In terms of the effect on the FFD designation for the salmonid watercourse the effects are considered to be ***moderate/large adverse***. This effect will occur due to the in channel works, however the use of the mitigation methods identified will reduce this to a local effect only.

In term of the effect on the groundwater quality the effect have to remain to be ***slight adverse***.

12.11 Assessment of Effects due to Operation

Operational phase effects are considered to include those associated with the use of the A8 by permanent road traffic use. This section describes the results of models produced in accordance with HD 45/09 Methods A, C and D and E, and includes a discussion of any additional risk assessment undertaken.

The significance of impacts has been assessed according to the magnitude of the effect, the probability of occurrence and the sensitivity of the receptors.

12.11.1 Effects on Surface Water due to Operation

12.11.1.1 Individual Assessment

A full water quality assessment has been carried out for all receiving watercourses in accordance with the methodologies outlined in HD 45/09. Table 68 summarises the results of the Method A – Simple Assessment which determines the in-channel dilution capacity of each receiving watercourse for the 2031 Do Something scenario. The results from the HAWRAT model are included in **Appendix G15, ES Volume II**.

Method A is only valid for permanently wet watercourses. HD 45/09 advises that impacts to watercourses with a Q95 of 0.001 m3/s or less are assessed as impacts to groundwater using Method C.

Table 68 **Summary of Method A Assessment**

Outfall Location	Step 1 Pass	Step 2 Tier 1 Pass	Step 2 Tier 2 Pass
1	Fail	Fail	Low flow Assessed as discharge to groundwater
4	Fail	Fail	Pass
5	Fail	Fail	Pass
6	Fail	Fail	Fails toxicity test for Copper
7	Fail	Fail	Pass
8	Fail	Pass	Pass
9	Fail	Fail	Pass
10	Fail	Fail	Pass
10a	Fail	Fail	Low flow Assessed as discharge to groundwater
13	Fail	Fail	Pass
15	Fail	Fail	Pass
16	Fail	Pass	Pass
17	Fail	Fail	Low flow Assessed as discharge to groundwater
18	Fail	Pass	Pass

Outfall Location	Step 1 Pass	Step 2 Tier 1 Pass	Step 2 Tier 2 Pass
19	Fail	Pass	Pass

As Table 68 indicates, all but four of the watercourses have been assessed as having sufficient channel dilution to prevent the river quality rising above the acceptable limits set out in the FD and HAWRAT and as such are not considered to pose a significant threat to water quality, ecology or amenity value. These outfalls have been assessed as having a ***neutral*** impact.

The receiving watercourses where Outfalls 1, 10a and 17 are proposed have flows that are considered to be too low to assess in accordance with Method A. In compliance with HD 45/09, these have been assessed as potential discharges to groundwater using Method C. The assessments of these two outfalls have therefore been included in chapter 12.11.2.

The watercourse to which Outfall 6 is proposed to be discharged has a low level of in-channel dilution, and as a consequence it is assessed to exceed the threshold for copper toxicity two times per year. While the Runoff Specific Threshold (RSTs) 24 threshold within HAWRAT is two exceedances per year the model has indicated a fail. This is assumed to be due to rounding of resulting in the model not showing the complete result. This is confirmed by the 99%ile figure being greater than the RST 24 threshold of 21ug/l at 24.66ug/l. However this indicates that the fail is very marginal. The magnitude of the impact is therefore minor.

The watercourse has been classed as having moderate ecological potential and is also designated as a Salmonid watercourse and is therefore considered to have a very high sensitivity. The significance of the effect is therefore to be ***moderate/large adverse***. However, the assessment indicates that copper levels fall well below the set EQS threshold.

12.11.1.2 Cumulative Assessment due to Operation

The HAWRAT assessment has been used to consider the cumulative impact of outfalls.

Outfalls 7 and 8 are in close proximity of each other, so a cumulative assessment was carried out for both soluble pollutants and sediments.

Several other outfalls fall within the defined distances of between 100m and 1000m of each other, and therefore three further assessments for soluble pollutants were carried out, in accordance with HD 45/09.

For the purpose of the cumulative assessments the impermeable area of the highway was summed for each outfall and the receiving watercourse Q95 was calculated to reflect the combinations of flows.

Table 69 summarises the cumulative assessment of outfalls. The output files from the HAWRAT model are included in **Appendix G15, ES Volume II**.

Table 69 **Cumulative Assessment of Outfalls**

Outfall Location	Step 1 Pass	Step 2 Pass
4 and 5	Fail	Pass
7 and 8	Fail	Pass
10a and 13	Fail	Pass
15, 16 and 17	Fail	Pass

The cumulative assessment of 4 and 5, which used a summed total of the Q95 for both watercourses, showed that there was not a significant cumulative effect.

The cumulative assessment of 7 and 8 used the Q95 for Ballynure Water as both discharge in close proximity into Ballynure Water. A significant cumulative effect was not predicted.

The cumulative assessment of Outfalls 10a and 13 considered a Q95 flow for the Larne River, as the point at which the flows joins is within the Larne River. The assessment indicates that there is no significant cumulative effect.

The cumulative assessment of Outfalls 15, 16 and 17 used a summed total of the Q95 for the Larne River and the Larne River tributary 4. The assessment indicates that there is no significant cumulative effect.

The cumulative effect of outfall on surface water quality has been assessed as having a ***neutral*** impact.

12.11.2 Assessment of Pollution Effects of Routine Runoff on Groundwater due to Operation

The scheme design is for routine runoff to be discharged to surface watercourses. However, a number of the ditches into which the carriageway runoff would be discharged are intermittently dry in the summer months.

Outfall 1 (1N and 1S), 10a and 17 have Q95 flows of 0.001m^3/s or below. Therefore, in line with HD 45/09, these proposed outfall locations have been assessed as discharges to groundwater and potentially impacting on groundwater quality.

Parameters relating to the source of potential pollution and pathway to receptor have been assessed on a site specific basis for Outfall 1 (1N and 1S) 10a and 17, in the matrices presented in Table 52.

The proposed scheme overlies a minor aquifer, which, according to Table A4.3 of HD 45/09, has a medium sensitivity in terms of groundwater vulnerability.

The full assessment for the impact to the groundwater body and specific receptors is provided in **Appendix G16, ES Volume II.**

12.11.2.1 Outfall 1 (1N and 1S)

Method C

The overall risk score of 176.5 is within the 150 to 250 HD 45/09 suggested action class range, which indicates there is a medium risk of impact of moderate magnitude as a result of discharge to groundwater from routine runoff at outfall 1.

For the medium risk, impact mitigation measures should be considered to protect groundwater. HD 45/09 suggests that the need for mitigation measures should be informed by additional risk assessment.

The groundwater at the location of outfall 1 is considered to be of medium sensitivity, as defined in Table 53. The medium risk to groundwater identified indicates that the effect on groundwater is moderate adverse, as set out in Table 54. The significance of the impact of the discharge to groundwater at Outfall 1 is therefore considered to be ***moderate adverse*****.**

Additional Risk Assessment

The result of the Method C assessment indicates that the impact of routine runoff from Outfall 1 discharging to groundwater to be moderate adverse for the entire groundwater body. As a result of dilution and degradation of contaminants within groundwater, this is unrealistic conclusion. As a result, additional risk assessment was carried out for Outfall 1 to understand the extent of the moderate adverse significance of impact. This was carried out in accordance with the Environment Agency's (England and Wales) P20 Hydrogeological Risk Assessment for Land Contamination; see **Appendix G16, ES Volume II.**

The result of the assessment demonstrates that the remedial targets for the marker contaminants, copper and zinc, are greater than the initial contaminant concentrations for a compliance point at a distance of approximately 40m from the point source of Outfall 1. Therefore the initial moderate adverse significance of impact to groundwater, as defined by Method C, is restricted to within a radius of 40m of Outfall 1.

The closest receptor to Outfall 1 is the Ballylinny Burn, which is approximately 70m south of Outfall 1N. Therefore in accordance with additional risk assessment, it is anticipated that the moderate adverse significance of impact, as defined by Method C, will not significantly affect any receptors within the vicinity of Outfall 1.

12.11.2.2 Outfall 10a

Method C

The overall risk score of 176.5 is within the 150 to 250 HD 45/09 suggested action class range, which indicates there is a medium risk of impact of moderate magnitude as a result of discharge to groundwater from routine runoff at Outfall 10a.

For the medium risk, impact mitigation measures should be considered to protect groundwater; HD 45/09 suggests that the need for mitigation measures should be informed by additional risk assessment.

The groundwater at the location of Outfall 10a is also considered to be of medium sensitivity. The medium risk to groundwater identified indicates that the effect on groundwater is moderate adverse. The significance of the impact of the discharge to groundwater at Outfall 10a is therefore also considered to be ***moderate adverse*.**

Additional Risk Assessment

The result of the Method C assessment indicates that the impact of routine runoff from Outfall 10a discharging to groundwater to be moderate adverse for the entire groundwater body. As a result of dilution and degradation of contaminants within groundwater, this is unrealistic conclusion. As a result, additional risk assessment was carried out for Outfall 10a to understand the extent of the moderate adverse significance of impact. This was carried out in accordance with the Environment Agency's P20 Hydrological Risk Assessment for Land Contamination; see **Appendix G16, ES Volume II.**

The result of the assessment demonstrates that the remedial targets for the marker contaminants, copper and zinc, are also greater than the initial contaminant concentrations for a compliance point at a distance of approximately 40m from the point source of Outfall 10a. Therefore the initial moderate adverse significance of impact to groundwater, as defined by Method C, is restricted to within a radius of 40m of Outfall 10a.

The closest receptor to Outfall 10a is the Six Mile Water, which is approximately 100m south west of Outfall 10a. Therefore in accordance with additional risk assessment, it is anticipated that the moderate adverse significance of impact, as defined by Method C, will not significantly affect any receptors within the vicinity of Outfall 10a.

12.11.2.3 Outfall 17

Method C

The overall risk score of 176.5 is within the 150 to 250 HD 45/09 suggested action class range, which indicates there is a medium risk of impact of moderate magnitude as a result of discharge to groundwater from routine runoff at Outfall 17.

For the medium risk impact, mitigation measures should be considered to protect groundwater. HD 45/09 suggests that the need for mitigation measures should be informed by additional risk assessment.

The groundwater at the location of Outfall 17 is also considered to be of medium sensitivity. The medium risk to groundwater identified indicates that the effect on groundwater is moderate adverse. The significance of the impact of the discharge to groundwater at Outfall 17 is therefore also considered to be ***moderate adverse*.**

Additional Risk Assessment

The result of the Method C assessment indicates that the impact of routine runoff from Outfall 17 discharging to groundwater to be moderate adverse for the entire groundwater body. As a result of dilution and degradation of contaminants within groundwater, this is unrealistic conclusion. As a result, additional risk assessment was carried out for Outfall 17 to understand the extent of the moderate adverse significance of impact. This was carried out in accordance with the Environment

Agency's P20 Hydrological Risk Assessment for Land Contamination; see **Appendix G16, ES Volume II**.

The result of the assessment demonstrates that the remedial targets for the marker contaminants, copper and zinc, are also greater than the initial contaminant concentrations for a compliance point at a distance of approximately 40m from the point source of Outfall 17. Therefore the initial moderate adverse significance of impact to groundwater, as defined by Method C, is restricted to within a radius of 40m of Outfall 17.

The closest receptor to Outfall 17 is the Larne River, which is approximately 45m east of Outfall 17. Therefore in accordance with additional risk assessment, it is anticipated that the moderate adverse significance of impact, as defined by Method C, will not significantly affect any receptors within the vicinity of Outfall 17.

12.11.2.4 Effects on Groundwater Flow due to Operation

Whilst changes will be made to the groundwater levels during construction of the scheme, a short period after completion of construction groundwater levels within the scheme assessment area will equilibrate, and no significant further changes to groundwater levels are likely as a result of operation. The effects of the scheme on groundwater flow during operation are therefore considered to be ***negligible***.

12.11.2.5 Significance of Effects on the Groundwater Environment due to Operation

The significance of effects of operation on the groundwater environment as detailed in chapter 12.11.2 are summarised below.

For all outfalls along the proposed scheme, with the exception of 1, 10a and 17, routine runoff is anticipated to discharge to surface water. As a result, at these outfalls, the significance of effect in terms of the pollution effects on the groundwater environment is neutral and the magnitude is negligible.

At certain times of the year Outfalls 1, 10a and 17 are anticipated to discharge to groundwater. Therefore in accordance with HD 45/09, these outfalls have been assessed using the Method C assessment for routine runoff discharging to groundwater. This established a medium risk score for discharge to groundwater which corresponds with a moderate significance of effect and a moderate adverse magnitude in terms of the pollution effects on the groundwater environment.

Additional assessment for Outfalls 1, 10a and 17, prompted by the moderate adverse magnitude of effect, concluded that this moderate adverse effect will be limited to a 40m radius of the point source at each outfall. No receptors were identified within a 40m radius of Outfalls 1, 10a and 17, therefore no mitigation measures are necessary.

As described in chapter 12.11.2.4, effects on groundwater flow are anticipated to be minimal; therefore the significance of effect is considered neutral and the magnitude ***negligible***.

The significance of effects of operation on the groundwater environment is summarised in **Appendix G17, ES Volume II.**

12.11.3 Assessment of the Risk of Pollution from an Accidental Spillage due to Operation

The risk of an accident resulting in a serious pollution incident on the proposed scheme has been assessed for each proposed drainage reach using the HD 45/09 Method D assessment. This assessment has been carried out using the proposed general strategy for the scheme and the design year (2031) AADT flows. Results of the Method D assessment are summarised in Table 70.

Table 70 **Method D Accidental Spillage Risk Assessment**

Outfall	Risk of Accidental Spillage to Surface Water (P_{INC}[83])	Reduced Risk of Accidental Spillage to Surface Water (Reduced P_{INC}[84])	Pass	Risk of Accidental Spillage to Ground-water (P_{INC}[83])	Reduced Risk of Accidental Spillage to Ground- water (Reduced P_{INC}[84])	Pass
Ballylinny Burn Tributary 1	0.039%	0.020%	✓	0.020%	0.010%	✓
Ballymena Burn Tributary 1	0.020%	0.010%	✓	0.010%	0.005%	✓
Ballymena Burn	0.013%	0.006%	✓	0.006%	0.003%	✓
Green Burn	0.039%	0.019%	✓	0.019%	0.010%	✓
Outfall 7	0.063%	0.032%	✓	0.032%	0.016%	✓
Six Mile Water (via sump)	0.054%	0.027%	✓	0.027%	0.013%	✓
Existing A8 drainage network	0.000%	0.000%	✓	0.000%	0.000%	✓
Six Mile Water Tributary 1	0.014%	0.007%	✓	0.007%	0.004%	✓
Six Mile Water Tributary 2	0.010%	0.005%	✓	0.005%	0.003%	✓
Larne River	0.103%	0.052%	✓	0.052%	0.026%	✓
Glen Burn	0.003%	0.002%	✓	0.002%	0.001%	✓

[83] P_{INC}* - the probability of a spillage accident with an associated risk of a serious pollution incident occurring.
[84] Reduced P_{INC}* - the reduced probability of a spillage accident with an associated risk of a serious pollution incident occurring due to inclusion of bypass petrol interceptor.

Outfall	Risk of Accidental Spillage to Surface Water (P_{INC}[83])	Reduced Risk of Accidental Spillage to Surface Water (Reduced P_{INC}[84])	Pass	Risk of Accidental Spillage to Ground-water (P_{INC}[83])	Reduced Risk of Accidental Spillage to Ground- water (Reduced P_{INC}[84])	Pass
Larne River Tributary 5	0.056%	0.028%	✓	0.029%	0.014%	✓

On all roads there is a risk that an accidental spillage or vehicle fire may lead to an acute pollution incident. It is generally accepted that the risk on any road is proportionate to the risk of an HGV road traffic accident. As new or improved roads are designed to reduce the accident rate, they will also lead to fewer acute pollution impacts. Where a spillage does reach a surface watercourse the pollution impact can be severe, but is usually of short duration, typically of an acute pollution impact.

The acceptable risk of a pollution incident is stated in HD 45/09 as an annual probability of less than 1% which is equivalent to a return period of 1 in 100 years for discharges to reaches of sensitive watercourses or to aquifers. As illustrated in Table 70, the probability that a spillage would cause a pollution incident is less than 1% for outfalls draining all sections of the A8 Dualling scheme, which indicates that specific mitigation measures are not required.

Although the calculations show that mitigation is not required, petrol interceptors have been included in the environmental design as standard. These have an indicative pollution risk reduction factor of 50%, which reduces the risk of an effect of an accidental spillage.

Tables containing the results of the Method D assessment are reproduced in full in **Appendix G18 ES Volume II**.

Effects Resulting from Accidental Spillages

The proposed scheme has been designed to improve road safety. As accidental spillages are most commonly a direct result of vehicle accidents, the improvement in road safety will result in a reduced risk of accidental spillage.

The Method D assessment indicates that all drainage catchments comprising the proposed 2031 Do Something scenario which deliver runoff to each reach of the receiving watercourses are within the acceptable risk limit of 1% for sensitive watercourses.

Further, the inclusion of bypass petrol interceptors in the drainage design will reduce the effect resulting from accidental spillages. The overall significance of effects is therefore neutral.

The magnitude of the effect of accidental spillage pollution events is therefore ***negligible*** for all receiving watercourses.

12.11.4 Assessment of Flood Risk due to Operation

From **Drawing A8-S3-0598 Rev I0, Appendix G10, ES Volume II** it can be seen that the proposed highway does not encroach significantly on the Q_{100} flood plain (either the NIRA or revised Arup flood plain). There is some marginal encroachment at chainages at approximately 700m and the existing undersized culverts currently cause upstream ponding at 2,000m, 2,450m, 2,550m and 3,000m.

At the locations of under undersized culverts the new highway will be on the downstream side of the existing carriageway so will not encroach onto the ponded flood plain. If the new culverts are sized to pass the Q_{100} flow, the model shows that these areas would not flood, see **Appendix G11, ES Volume II**.

From **Drawing A8-S3-0599 Rev I0, Appendix G10, ES Volume II** it can be seen that the proposed highway will encroach on the Q_{100} flood plain at:

- Ch 9+950m to Ch 10+075m, east of the proposed scheme. The eastern toe of the existing A8 embankment will marginally overlap into the Q_{100} flood plain, over an area of up to 0.05ha with an average depth of 0.15m. It is proposed that the watercourse is diverted to the east over this section;
- Ch 10+100m, west of the proposed scheme. At this location, it is proposed that Moss Road junction will extend over a 0.l7ha area of the flood plain with an average depth of 0.3m. It is proposed that the existing river is diverted to the south of this location;
- Ch 10+650m to 10+775m, east of the proposed scheme. At this location the on-line widening is proposed to the west; therefore, the eastern extent of the proposed highway would be the same as the existing. There would therefore be no further encroachment into the Q_{100} flood plain apart from a 120m length of farm access track that would take up an area of 0.12ha with an average depth of 0.3m;
- Ch 11+900m to 12+100m, east of the proposed scheme. At this location it is proposed that the Deerpark Road junction will extend over a 0.4ha of the Q_{100} flood plain to an average depth of 0.25m. The Larne River is proposed to be diverted to the east at this point;
- Ch 12+300m to 12+600m, east of the proposed scheme. It is proposed that the eastern toe of the mainline embankment will extend into the Q_{100} flood plain, taking up an area of 0.36ha to an average depth of 1.0m. The Larne River is proposed to be diverted to the east over this length;
- Ch 12+900m to 13+200m, east of the proposed scheme. The proposed scheme will take up some 0.52ha of the Q_{100} flood plain, with an average depth of 0.5m. In addition a farm access track is proposed over an area within flood plain; and
- Proposals to keep the existing undersized structures at Ch 13+800m and 14+300m, are likely to retain the current ponding conditions upstream.

As summarised above, the encroachments upon the Q_{100} flood plain are marginal.

The HEC-RAS analysis for the proposed scheme under a Q_{100} flood event between Ch 12+900 and 13+200 was carried out and compared to such an event under existing conditions. The details are provided in **Drawing A8-S3-0580 Rev I0, Appendix G19, ES Volume II**. The analysis shows that there is no significant increase in flood level within the catchment down-gradient of the stream that crosses the proposed mainline between chainages of Ch 0+510m and 0+540m on the drawing.

12.11.4.1 Effects on Flood Risk due to Operation

Based on the analysis detailed above, the proposed encroachment by the development on the flood plain will not have a significant effect on the Q_{100} flood plain. Any effect is therefore considered ***negligible***.

12.11.4.2 Effects on Surface Water Flows due to Operation

Following completion and opening of the A8 Dualling, surface runoff flows are expected to increase due to larger volumes of routine runoff and groundwater drainage generated by the increased carriageway area and groundwater drainage measures. The attenuation assessment report has identified that even though the combined highway and catchment peak flows do not cause the combined hydrograph peak to raise by 5%, the increase in surface water flows from Outfalls 1, 4, 5, 6, 9, 10 and 10A pose an increased risk to downstream properties. All other outfalls were considered not to have a significant effect. The environmental design therefore provides attenuation for these outfalls, discharging runoff to the catchments at the equivalent of the Greenfield runoff rate. Therefore the effect of the additional surface water on downstream flows is considered to be ***negligible***.

12.11.5 Assessment of Effects on Geomorphology due to Operation

Site 1 - Chainage 3+000m and Site 3 - Chainage 10+100m

Realignment will alter the gradients of these watercourses, which could alter the depositional/erosion potential of the flow regime. Because of the low geomorphological quality of these sections of watercourse, any effects are considered to be negligible.

Site 2 - Chainage 5+600

The Ballynure water at this site has well defined geomorphological features (pools/riffles/runs) which are located within a sinuous and largely natural channel.

The proposed location of the scheme and associated river culvert in this location will cause deterioration in levels of physical habitat quality at the site and may have negative impacts on fish passage. A culvert will have the potential impact on local sediment transport patterns, and result in downstream effects, as sediments will pass through the culvert more readily before being deposited immediately downstream. Depending on the capacity of the culvert it could change the hydromorphological nature of the river downstream.

A new culvert would have an adverse effect on the geomorphology of the river at this location possibly downstream and would work against the objectives of the European Water Framework Directive. The effect at this location is therefore considered to be adverse.

Site 4 - Chainage 12+000

The proposed scheme will enhance the gromorphological characteristics of the currently degraded river channel at the quarry, as the straightened section is redirected so that it loops around the proposed new road layout. It provides a meandering section including riffles and pools. The section will be constructed to retain downstream controls (immediate bed levels and gradients) avoid impacts to the upstream section caused by changes in flow characteristics.

The effect of the proposed schemes in considered to be beneficial.

Site 5 - Chainage 12+500

The upstream section of the Larne River has been historically straightened and offers little geomorphological diversity as a result. The proposed scheme provides a more natural meandering section of river, away from the proposed widened road scheme, and reconnects a relict meander scroll to the north of the section. However the existing pool upstream of the culvert under the A8 will be lost.

The natural section upstream of the straightened section will be protected as much as possible by retaining downstream controls (immediate bed levels and gradients).

The proposed scheme at site 5 will provide an overall improvement to the current situation; however the loss of the poll will reduce this. The scheme at this site is considered to be beneficial.

Site 6 - Chainage 12+900

The realignment of the channel should be minimised as far as possible in the field in order to keep the similarities with the existing channel with regards to gradient. Boulders and boulder features should be translocated to similar river chainages to ensure that the new habitat is as similar as possible to the existing situation. If topographic information reveals that the new river layout is going to be heavily incised into the floodplain then it is recommended that the floodplain be remodelled/shaped in order to allow for similar levels of inundation during flood events.

The reach downstream of the A8 culvert in this river assessment reach has been identified as a sensitive receptor due to its high geomorphological quality and should not be adversely impacted upon based upon the current proposals.

The effect of the proposed schemes is considered to be negligible.

Site 7 - Chainage 13+800

The well sorted and defined bed material present in the river could be lost if the river is realigned. Boulders and boulder features should be translocated to similar river chainages to ensure that the new habitat is as similar as possible to the existing situation. Microtopographic bedforms should be created naturally after the first high flow. The old channel may be backfilled with material from the new channel, or could be used as a pond or backwater.

The effect of the proposed schemes is considered to be negligible.

12.11.5.1 Summary of significance of effects on geomorphology

The geomorphology of the rivers within the assessment area varies between high quality to low quality modified channels, however the total length of rivers affects, in relation to the catchment, is small. The effects from the various realignments are identified as adverse, negligible or beneficial. In relation to the effects on the wider catchment and the scaling of effects described in the HD

40/06 guidance, the significance of the overall effect is therefore considered to be ***neutral***.

However, while the overall effects are identified as neutral, consideration should be given to each individual realignment to reduce detrimental effects and maximise the potential benefits.

12.12 Mitigation of Effects due to Operation

This section identifies mitigation measures where adverse effects due to operation have been identified.

12.12.1 Routine Runoff on Surface Water

Outfall 6 was assessed to exceed the threshold for copper toxicity 2 times per year resulting in a ***slight adverse*** impact. However, the assessment indicates that copper levels fall well below the set EQS threshold.

The highway design incorporates petrol interceptors and attenuation ponds at Outfall 6. A proportion of the attenuation pond will be vegetated, creating a hybrid attenuation and wetland system. This will provide some treatment to the copper in the surface water.

12.12.2 Routine Runoff on Ground Water

The moderate adverse impacts posed by the discharge of road runoff to groundwater at Outfalls 1, 10a and 17 are localised impacts. As discussed in chapter 12.11.2, the moderate adverse significance of impact will affect the groundwater body and any receptors within a radius of 40m. It has been concluded that no receptors lie within this 40m radius, therefore no mitigation measures are necessary.

12.13 Residual Effects due to Operation

12.13.1 Routine Runoff on Surface Water

There is limited information available regarding the effectiveness of mitigation measures to remove soluble and sediment pollution. However guidance in HA 103/06 does give some indication of possible reduction rates within vegetated systems. Based on an assumed copper removal rate of 24% and a restricted discharge rate to the watercourse, based on the Greenfield runoff rate, the discharge to the watercourse is reduced and the number of exceedances per year of the copper threshold limit falls to below the limits set in the HAWRAT model. The effect on the watercourse is therefore considered to be ***negligible***.

12.13.2 Routine Runoff on Ground Water

The assessment of the impacts on groundwater identified ***moderate adverse*** effects on the groundwater at Outfalls 1 (1N and 1S), 10a and 17, to the proximity of the outfall to the groundwater. However further assessment indicated that the extent of contamination arising from the outfalls did not impact on any sensitive receptors. The effect is therefore considered ***negligible***.

12.14 Cumulative Effects

There are a number of relatively small residential developments proposed along the proposed scheme, some of which are already approved.

Due to their nature and scale, the cumulative effects on the water environment due to the A8 dualling and other proposed developments on the water environment are considered to be negligible.

13 Noise and Vibration

13.1 Introduction

This chapter presents an assessment of the effects upon the local noise environment as a result of the upgrading of 14km stretch of the A8 Belfast to Larne Road from Coleman's Corner to the B100 (Ballyrickard Road), from single carriageway to dual carriageway standard.

It describes the approach and methods used for this assessment outlines the baseline noise climate and provides the results of a Detailed Assessment of the scheme. Details of proposed mitigation measures and an assessment of residual noise impacts and effects are also presented.

The assessment has been carried out according to a methodology based on the guidance provided in the Design Manual for Roads and Bridges (DMRB) Volume 11 Section 3 Part 7 (HA 213/08), 'Noise and Vibration' for a Detailed Assessment which is described in HA 213/08 section 12.4.4.

The noise impacts during the construction of the scheme are also considered.

13.2 Legislation and Guidance

13.2.1 Design Manual for Roads and Bridges – Environmental Assessment

The Department for Regional Development (DRD) advocates the use of DMRB as the regulatory standard for the design of a new road or improvements to an existing road. In particular, Volume 11 Section 3 Part 7 (HA 213/08) sets out the method for assessing noise and vibration associated with road traffic. DMRB provides guidance on the selection of the scheme assessment area and the relevant assessment years. This procedure has been adopted by the Northern Ireland Roads Service for the purpose of this assessment.

13.2.2 Part V of The Roads (Northern Ireland) Order 1993

The environmental assessment of road construction and improvement schemes is governed by Part V of The Roads (Northern Ireland) Order 1993([85]) which implemented Council Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment, as amended by Directive 97/11/EC and Directive No. 2003/35/EC.

13.2.3 Calculation of Road Traffic Noise

DMRB dictates that road traffic noise is calculated under the method described in Calculation of Road Traffic Noise (CRTN). This describes a procedure for determining the level of noise from the highway based on the traffic parameters and the propagation distance and conditions between the highway and receiver.

[85] Part V was substituted by the Roads (Environmental Impact Assessment) Regulations (Northern Ireland) 1999, (S.R. 1999 No. 89) and amended by The Roads (Environmental Impact Assessment) Regulations (Northern Ireland) 2007 (S.R. 2007 No. 346)

This is the accepted methodology to quantify traffic noise levels for use with the following assessment procedures.

13.2.4 The Noise Insulation Regulations (Northern Ireland) 1995 (Noise Insulation Regulations)

The Noise Insulation Regulations (Northern Ireland) 1995 define the conditions under which dwellings are eligible for noise insulation to control internal noise levels. The conditions relate to the level of traffic noise at the façade, the increase in noise levels as a result of the highway and the contribution of the new or altered scheme to the noise level received at the façade.

In summary, noise insulation qualification criteria require that:

- The facade noise threshold of 68dBL_{A1018h} is met or exceeded;
- That there must be a noise increase of at least 1dB(A) compared to the prevailing noise level immediately before the construction of a highway or an additional carriageway were begun;
- That the property is 300 metres or less from the nearest point on the carriageway of a highway to which the Regulations apply; and
- The numbers of properties that are likely to be eligible for statutory insulation are identified as part of this assessment.

13.2.5 BS 5228 Noise and Vibration Control on Construction and Open Sites

The Control of Noise (Codes of Practice for Construction and Open Sites) Order (Northern Ireland) 2002 approves the following British Standards Institution codes of practice for appropriate methods of minimising noise and vibration from construction and open sites in Northern Ireland:

- BS 5228: Part 1: 1997 (with Amendment 1);
- BS 5228: Part 3: 1997;
- BS 5228: Part 4: 1992 (with Amendment 1); and
- BS 5228: Part 5: 1997.

BS 5228 provides guidance on the assessment and control of noise from construction operations. The Standard contains detailed information on noise reduction measures and promotes the ‘best practicable means’ approach to control noise and minimise the impact on local residents and construction workers.

13.2.6 The Pollution Control and Local Government (Northern Ireland) Order 1978

The Pollution Control and Local Government (Northern Ireland) Order 1978 gives the Local Authority powers to serve a notice to the developer requiring the control of site noise under Section 40 of the Order. This may include specific controls to restrict certain activities identified as causing particular problems. Conditions regarding hours of operation will generally be specified and noise and vibration limits at certain locations may be applied in some cases. All requirements must adhere to established guidance and be consistent with best practicable means to control noise only as far as is necessary to prevent undue disturbance.

13.3 Scoping and consultation

13.3.1 Scoping

An ES Scoping Report was issued in March 2010 to key statutory and non-statutory bodies outlining the approach, methodology, baseline conditions and expected effects of the scheme.

It was circulated to all stakeholders, offering them an opportunity to address the proposed methodologies for the EIA or to address issues that have not been adequately covered. A list of consultees is included in chapter 7.3.

The approach to the study was described and in particular the noise sensitive locations around the study area were discussed to reach agreement on baseline measurement and assessment locations.

13.3.2 Consultation

Additional consultation has been undertaken with representatives of Newtownabbey and Larne Borough Councils regarding the noise assessment through the ELG meetings (see chapter 7.2.2). Details of noise issues discussed with all consultees are documented within Table 14.

13.4 Assessment Methodology

13.4.1 Introduction

The following sections describe the assessment methodology used to carry out the assessment of noise impacts and effects associated with the scheme based on the guidance and legislations described earlier.

13.4.2 Overall Approach

The DMRB approach to assessing traffic noise impact is to compare the noise levels for the Do Something scenario (with proposed scheme) against noise levels for the Do Minimum scenario (without scheme). The method requires that comparisons are made between the baseline noise situation (before the change produced by the scheme) and the noise level in the worst-case year in the first 15 years after opening (i.e. generally the future year which would have the maximum traffic flow 15 years after opening). The noise change at the opening year is also considered.

A ‘simple assessment’ of the preliminary scheme design was carried out in July 2009 as part of the Stage 2 environmental assessment. At Stage 2, three engineering options were presented for Section A at Bruslee, six options for Section B at Ballynure, and one option (online) for Section C between Ballynure and Millbrook roundabout.

Results from the simple assessment showed that for all options, at least one dwelling may be subject to an increase of 3dB(A) or more in the future year.

Section 3.4.1 ii) of DMRB states that the assessment should progress to 'Detailed' level if:

'*an increase in noise of 3dB(A) or more at any dwelling within the scheme assessment area during the first 15 years as a result of the scheme'* is predicted.

Therefore, a Detailed Assessment has been carried out for the preferred scheme option. In addition to the assessment of noise change, the Detailed Assessment describes a method for the rating the change in noise nuisance level that would be experienced by local residents.

The preliminary scheme design includes the closure of Church Road and the creation of a new link road between Church Road and the A57 Templepatrick Road junction .A specific assessment method has been devised in order to predict the impact of changes in road traffic noise along these links. This is outlined in chapter 13.4.5.2.

13.4.3 Methodology for Establishing Baseline Conditions

For the 'simple' assessment, the noise assessment was carried out using predicted noise levels. At 'Detailed' level, DMRB recommends that a baseline noise survey is carried out to provide additional information on the noise climate within the study area.

A survey of baseline noise was carried out between 11th-13th May 2010, and performed in accordance with the 'Shortened measurement procedure', described in paragraph 43 of CRTN. Full details of the survey are provided in **Appendix H, ES Volume II**.

13.4.4 Methodology for Assessing Effects due to Construction

Although detailed construction methodology has been developed, the construction assessment was concentrated to two scenarios. A worst-case and a typical case, these were determined from the construction programme and represent the noisiest construction activities which may occur simultaneously along a given section (chainage) of the A8 scheme. Therefore, the construction noise and vibration effects have been assessed by considering the likely range of generic construction processes associated with the works and their typical durations.

For the purposes of the noise assessment, the construction activities for typical highway construction (i.e. proposed new and upgraded roads) are categorised into five major activities as follows:

- Site clearance;
- Earthworks (and piling);
- Drainage / lighting;
- Pavement construction; and
- Structures (junction works).

The noise calculation methodology presented in BS 5228 will be used to predict construction noise at a range of distances away from the scheme boundary. By firstly comparing the predicted level of construction noise to the construction noise significance criteria set out in Annex E (E3.3) of BS 5228 (2009) and then where appropriate comparing to the baseline road traffic noise, an assessment of noise impact can be made.

13.4.5 Methodology for Assessment of Effects due to Operation

13.4.5.1 Road Traffic Noise

Geographical Information Systems (GIS) have been used to construct a 3-dimensional noise model of the study area. The model includes terrain data, buildings and other structures that might screen or reflect noise, ground cover types and road links. Drawings of the scheme design and groundworks were incorporated to ensure an accurate representation of the proposed scheme.

For each road link in the model, data on traffic flow, speed, proportion of heavy goods vehicles (HGVs) and road surface type were obtained from the project traffic and highways engineers for inclusion into the model. Noise level calculations according to CRTN were carried out using proprietary noise modelling software. Traffic noise levels were calculated across a grid of receiver positions over the study area, and contours of noise level exposure were established. Additional calculations were also conducted at each property facade to establish noise and nuisance change at each dwelling.

The traffic data used in the model were those projected with and without the proposed scheme both in the baseline year (2016) - i.e. opening year - and those projected in the future assessment year i.e. the year of maximum projected traffic flow within 15 years of opening – in this case, the future year (2031). These traffic data were combined with the physical data to produce the following four scenarios:

- Do Minimum (without the proposed scheme) in the opening year (2016);
- Do Minimum (without the proposed scheme) in the future assessment year (2031);
- Do Something (with the proposed scheme) in the opening year (2016); and
- Do Something (with the proposed scheme) in the future assessment year (2031).

The noise study area is primarily defined in DMRB Volume 11 Section 3 Part 7 (HA 213/08) as 600m around new or altered highways and sections of existing roads within 2km of the new works that are predicted to be subject to a change in noise level of more than 1dB(A) as a result of the proposed scheme on opening. Existing roads subject to a change of 1dB(A) or more were identified by traffic forecasts predicting, as required by DMRB, an increase in flow by at least 25% or decrease by 20% in the scheme opening year (although ignoring those where the predicted traffic flow was <1000 AAWT18hr in both with-scheme and without-scheme scenarios[86]). Collectively these are called 'affected routes'.

The study area also includes affected routes beyond 2km from the new works. However, for these routes an assessment of noise changes is carried out using Basic Noise Level (BNL) where dwellings lie within 50m of affected routes. The BNL is the noise level at a reference distance of 10m from the carriageway edge, derived using CRTN methodology.

The noise model was used to calculate noise levels within the noise study area, at a height of 4m above local ground, in terms of the free-field $L_{A10,18h}$ index in accordance with CRTN methodology, (as required by DMRB), for each of the four scheme scenarios as listed above.

The $L_{A10,18h}$ index represents the arithmetic mean of all the hourly values of L_{A10} (A-weighted sound level in decibels that is exceeded for 10% of the measurement period) during the period between the hours of 06:00 and 24:00. The CRTN procedures assume typical noise propagation scenarios which are consistent with moderately adverse wind velocities in all directions. The additional advice given in DMRB has been adopted regarding CRTN procedures. These include revisions to vehicle classification, traffic data and corrections due to road surface.

Baseline noise survey results (as detailed in **Appendix H, ES Volume II**) were used to validate the range of predicted noise climates across the study area.

Noise difference contour maps were produced using the results from the calculations to graphically represent the noise changes within the noise study area. These noise maps are referenced in **Appendix H, ES Volume II.**

As part of the procedure for a Detailed Assessment, DMRB requires that the magnitude of the noise impact is reported using a suggested scale of magnitude to describe the increase or decrease in noise level associated with the proposed scheme. The magnitude scale is described in more detail in chapter 13.4.7.2, and is included in Table 71. Following the DMRB procedures, this assessment of impact magnitude is required for the following scenarios:

- Do Something scenario in the 2016 baseline year against the Do Minimum scenario in the 2016 baseline year; and
- Do Something scenario in the 2031 future assessment year against Do Minimum scenario in the 2016 baseline year.

To complete the noise change nuisance Assessment Summary Tables (ASTs) also required by DMRB, the noise model was also used to calculate the noise level at 1m from the centre of every façade longer than 2m of every building in the noise study area, at a height of 4m above local ground. Professional judgement was used to establish that due to the number of façades on some complex buildings it was reasonable to exclude façades <2m in length as most facades of this length would not contain a sensitive window.

To populate the ASTs (which quantify noise and estimated nuisance change), dwellings are classified according to their façade noise levels in the Do Minimum baseline year. Baseline noise levels are classified in 3dB(A) bands (47.5dB(A) to

[86] Eighteen hour flows <1000 were excluded as CRTN considers predictions of noise based on such flows to be unreliable.

83.5dB(A)) with a band for noise less than 47.5dB(A) and greater than 83.5dB(A) as required by DMRB). In the event that there is predicted to be a decrease on one façade and an increase on another, the worst-case predicted noise change in noise level is reported, i.e. the largest increase.

The traffic noise nuisance changes required by the ASTs have been calculated according to the DMRB method and presented in bands as follows: <10 percentage points, 10<20 percentage points, 20<30 percentage points, 30<40 percentage points and ≥40 percentage points.

For the Do Something scenario, it is the highest increase in nuisance that occurs between the opening and future assessment years that is reported; this often occurs in the opening year. This is because the short-term response curve used to calculate the nuisance level immediately after opening is likely to calculate a higher nuisance level than the steady-state curve which is used for the future year. The full details and background of the response curves described above is described in DMRB.

In addition to the above, a night-time noise assessment was conducted to establish if particular receptors may be more affected at night than during the daytime. This can occur due to disproportionately heavy night-time traffic volumes or because of atypical increases in the proportion of heavy vehicle traffic at night. The assessment is described in chapter 13.10.4.

The results of all the assessments have been used to develop appropriate noise mitigation. This is discussed in chapter 13.11 which considers further mitigation to reduce or remove significant effects evaluated for the base scheme. The resulting noise levels and residual significant effects following additional mitigation are assessed in chapter 13.12.

13.4.5.2 Methodology for Assessment of Noise Effects at Lower Ballyboley Road due to Church Road Link Road

The preliminary scheme design includes the closure of Church Road and the creation of a new link road between Church Road and the A57 Templepatrick Road junction. As a result of the closure of Church Road and the construction of this link road, traffic modelling has indicated that flows along Lower Ballyboley Road in the future year may increase slightly. The increases predicted in the traffic model for this area suggest that flows in some scenarios may just exceed 1000 AAWT 18hr and therefore need to be considered.

Where traffic flows on a link are predicted to be above 1000 AAWT 18hr for any scenario, the link has been considered for analysis. A count of the number of sensitive receivers within 50m of the road centreline has been carried out (similar to the BNL analysis method described in DMRB Vol 11 Sec 3 Part 7 3.31 iii)

The overall noise level from each link has been predicted via the method described in CRTN. A road height of 0m and a receiver height of 4m have been assumed for each calculation. The average distance from each receiver within 50m of the link to the road centreline has also been calculated, and this value is used for the propagation distance to the source. A 180° angle of view has been assumed.

The low flow correction as detailed in Chart 12 of CRTN has been incorporated as appropriate for each link. Where flow is predicted to be below 1000 in one scenario but above 1000 in another, flow values have been rounded up to 1000 to enable a comparative prediction under CRTN.

The results of this assessment are outlined in chapter 13.10.2.1.

13.4.5.3 Road Traffic Vibration

DMRB recommends that the effects of vibration should also be considered where appropriate. In the case of ground-borne vibration, the likelihood of perceptible vibration being caused is particularly dependent upon the smoothness of the road surface. Research has shown that vibration levels caused by heavy vehicles travelling at 110kph over a 25mm hump (i.e. a large discontinuity consistent with poorly backfilled trench) could cause perceptible vibration at up to 40m from the road (Watts, 1990). This would infer that it is unlikely that significant levels of vibration would be generated at distances greater than this. Also, with a newly laid road surface it is a requirement of new highway construction specification that the surface would be smooth and free from any discontinuities of this magnitude. DMRB Vol. 11, Section 3, Part 7 HA 213/08 Annex 2, paragraph A2.26 of DMRB states such vibrations are unlikely to be important when considering disturbance from new roads and an assessment would only be necessary in exceptional circumstances. No such exceptional circumstances are envisaged for this scheme and hence no impacts or effects from groundborne vibration are predicted.

The DMRB covers the potential for airborne noise, from heavy goods vehicles, to cause vibration nuisance close to main roads. As an indication of the scale of impact relative to noise effects, the guidance in DMRB paragraph HA 213/08 Annex 3, paragraph A3.22 states 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. On average traffic induced vibration is expected to affect a very small percentage of people at exposure levels below 58 LA10 dB. Also, the significance of any change in airborne traffic vibration can be considered proportional to the significance of changes in traffic noise. As such the assessment of airborne vibration can be considered included within the assessment of airborne noise.

13.4.6 Construction Noise Significance Criteria

Assessment of the significance of construction noise has been carried out based upon noise change as outlined in BS5228-1: 2009. The Standard provides a number of example methods for the assessment of significant effects. It is proposed that the ‘2-5dB(A) change’ method is used to establish the threshold of significant effect at dwellings. The procedure is described in Annex E (E3.3) of the Standard as follows:

‘*Noise levels generated by construction activities are deemed to be significant if the total noise (pre-construction ambient plus construction noise) exceeds the pre-construction ambient noise by 5 dB or more, subject to lower cut-off values of 65 dB, 55 dB and 45 dB L_{Aeq}, Period, from construction noise alone, for the daytime, evening and night-time periods, respectively; and a duration of one month or more, unless works of a shorter duration are likely to result in significant impact.*

These evaluative criteria are generally applicable to the following resources:

- *residential housing;*
- *hotels and hostels;*
- *buildings in religious use;*
- *buildings in educational use;*
- *buildings in health and/or community use.*

For public open space, impact might be deemed to be significant if the total noise (pre-construction ambient plus construction noise) exceeds the pre-construction ambient noise (L_{Aeq}, Period) by 5dB or more for a period of one month or more. However, the extent of the area impacted relative to the total available area also needs to be taken into account.'

13.4.6.1 Scheme Assessment Area and Representative Receptors for Construction Noise Assessment

Ordnance Survey data have been studied to establish potential noise sensitive receptors along the route to within 600m of the proposed scheme. Noise sensitive receptors considered include residential properties, educational buildings, churches, and recreational resources.

13.4.7 Operational Significance Criteria

13.4.7.1 Assessment of Significance

There is no established UK guidance which clearly defines criteria for the assessment of significant effects arising from road traffic noise. The response of people to noise is subjective and sensitivity to changes in traffic noise is therefore variable across the population. Given the variability of response and the potential for non-acoustic factors to influence perceptions of noise, any assessment of significance can only represent the general community response to traffic noise.

13.4.7.2 Traffic Noise Impact Evaluation

It is common practice to use the change in noise level climate brought about by a scheme as the basis for evaluating noise impacts (i.e. the impact of the scheme on the pre-existing noise environment and the effects this may have on the receptors in that environment).

The scale or severity of any noise change, positive or negative, requires description to indicate the degree of impact. This leads to the common practice of defining noise change impact categories with an associated semantic scale.

Decades of experience are probably best captured through the DMRB guidance on Noise and Vibration assessment (DMRB, Vol. 11, Section 3, Part 7 HA213/08) and the draft Guidelines for Noise Impact Assessment developed jointly by the Institute of Acoustics (IoA) and the Institute of Environmental Management and Assessment (IEMA) that were published in 2002.

Table 71 shows the magnitude of impact descriptors associated with different levels of noise change.

Table 71 **Classification of magnitude of noise impact under DMRB**

Noise Change [dB(A)]	Magnitude of Impact
0	No change
0.1 – 0.9	Negligible
1.0 – 2.9	Minor
3.0 – 4.9	Moderate
5.0 +	Major

The IoA/IEMA categories are equivalent in terms of noise levels. With respect to semantic descriptors, DMRB is the more recent guidance and is consistent with the current trend to unify all criteria around a minor, moderate and major impact severity structure.

The research cited by DMRB demonstrates that even for those most sensitive to short term change in noise, a change of less than 1dB is imperceptible and hence is a negligible impact on the environment.

13.4.7.3 Traffic Noise Significance Criteria - General

As discussed above, the effect of an impact on the noise environment will depend on the receptor subject to the impact.

Historically the assessment of significant noise effects was often based on exceeding the Noise Insulation Regulations (NIR) qualification level (i.e. 68dB $L_{A10,18h}$). This is accepted as a very high level of external noise where the noise insulation provided by closed single windows is insufficient to maintain internal noise levels that are consistent with quiet enjoyment of a property and restorative sleep.

DMRB provides the clearest guidance to date, where paragraph 3.42 of Chapter 3 of HA 213/08 notes that "*A change of 1 dB(A) in the short-term (e.g. when a project is opened) is the smallest that is considered perceptible. In the long-term, a 3 dB(A) change is considered perceptible, and such an increase should be mitigated if possible*."

For reference, other guidance citing the 3dB(A) threshold for perceptible noise change in the long term includes:

- Department For Transport, 1998, A New Deal for Trunk Roads in England: Guidance on the New Approach to Appraisal, HMSO;
- Department of the Environment, 1990, Report of the Noise Review Working Party 1990, HMSO;
- Institute of Environmental Assessment 1992, Guidelines for the Environmental Assessment of Road Traffic. IEA; and
- Department of the Environment (1994), Planning Policy Guidance 24, Planning & Noise, Department of the Environment.

Paragraph 3.42 of DMRB Volume 11 Section 3 Part 7 formally clarifies what had been common practice for many years: the use of a long-term noise change of 3dB(A) or greater as the basis for noise significance criteria (i.e. trigger for mitigation).

Therefore, as required by DMRB, the mainstay of the noise assessment will be the evaluation of the long-term noise change. This will be evaluated between the Do Minimum condition in the baseline year against the Do Something condition in the future year. The initial indicator for mitigation would be a change of 3dB(A) or more against this assessment although other criteria, as discussed later, will be used to refine the identification of significant effects and mitigation.

DMRB also notes that, following a change in traffic flow, perceptible changes have been reported in the short-term for traffic noise changes as small as 1dB(A). This is based on research of community response to noise indicating that people can be more sensitive to the abrupt noise change soon after opening of a new or altered scheme. The guidance notes that this heightened sensitivity to noise change is a temporary effect and the longer-term noise nuisance level after a number of years reverts to the ‘steady state’ level.

Other research also suggests that the reported sensitivity to small changes in noise levels (less than 3dB) may be coloured by factors other than noise (Baughan & Huddart, 1993).

As required by DMRB an assessment of the short term change in noise levels, comparing the Do Minimum condition in the baseline year against the Do Something condition, will be undertaken.

DMRB describes a procedure for assessing noise nuisance experienced alongside the highway. Noise changes of 1dB(A) or more are related to the estimated change in the ‘percentage of people bothered very much or quite a lot by traffic noise’. Although the DMRB method does not rate the noise change in terms of the significance of the effect, it suggests that a proportion of the community may report a change in nuisance level following noise changes as small as 1dB(A). Thus the assessment of noise change in the year of opening provides useful information as to where people may initially perceive an increase in noise nuisance – albeit not necessarily entirely due to noise - even though the long term noise effect may not justify noise mitigation.

There may of course also be areas where the year of opening assessment suggests a level of community response in the short term due to noise changes between 1 and 3dB(A) and where mitigation is provided because the noise change increases to 3dB(A) or more in the long term.

Whilst DMRB does not advocate use of absolute noise levels as a means of assessing noise impact or effects on receptors the IoA/IEMA Guidance notes that relying solely on noise change may not be always appropriate. There are two sets of circumstance that in particular warrant some further consideration:

- Already very noisy locations: Receptors may already be exposed to very high levels of noise from other sources and hence any increase in noise may be considered unsatisfactory and hence additional effort may need to be made to reduce the projected noise increase; and
- Tranquil areas: In areas formally recognised for their tranquillity because of low noise levels, small increases in noise may again be considered significant.

13.4.8 Proposed Traffic Noise Significant Criteria for Scheme

On this basis, Arup has developed significance criteria for changes in road traffic noise at sensitive receivers. These are given below in Table 72 alongside the DMRB impact magnitude criteria for comparison.

Table 72 **Assessment of magnitude and significance of impact**

Change in Noise Level (dB(A))	Impact Category (DMRB)	Initial Indicator of Significance
+5 or greater	Major adverse	Potentially significant increase
+3 to +4.9	Moderate adverse	
+1 to +2.9	Minor adverse	Unlikely to be significant
+0.9 to -0.9	Negligible	Not significant
-1 to -2.9	Minor beneficial	Unlikely to be significant
-3 to -4.9	Moderate beneficial	Potentially significant decrease
-5 or less	Major beneficial	

13.4.8.1 Traffic Noise Significance Criteria – Residential

Significant effects on residential receptors are identified using professional judgement based on the following criteria:

- Number of receptors subject to the noise impact;
- The proportion of the community within which the receptors reside subject to the impact; and
- The magnitude of the impact; and existing absolute noise levels (particularly very noisy and quiet / tranquil areas).

13.4.8.2 Traffic Noise Significance Criteria – Non Residential

Significance of noise change at non-residential sensitive receptors will be based on these same criteria. Each non-residential noise sensitive receptor will then be subject to a specific assessment taking into account matters such as:

- Use (e.g. educational, healthcare, religious buildings or community uses) and hence relevant guidance on noise;
- The times of use;
- Existing internal noise levels;
- The design of the receptor (esp. windows, doors and ventilation systems) and hence ability of receptor to experience changes in external noise environment without significant change in internal noise conditions); and
- The sensitivity of the occupants.

13.5 Assumptions and Limitations

13.5.1 Assumptions

Assumptions used in the construction of the operational noise model are described in chapter 13.4.

13.5.2 Limitations

Following completion of the noise modelling, a subsequent change has resulted in the closure of Church Road and the creation of a new link between Church Road and the A57 Templepatrick Road junction. As a result of the construction of this link road, traffic modelling has indicated that flows on particular sections of Lower Ballyboley Road may increase slightly, to above 1000 AAWT 18hr. Links where the flow exceeds the calculation threshold level of 1000 AAWT 18hr in any scenario should be considered for analysis.

Although the traffic changes on these links are comparatively small, and the change would be considered unlikely to cause effects, a method has been devised in order to determine the impact of changes in road traffic noise along these links. The changes have not been modelled to provide an updated noise map, but this method provides a prediction of the noise change as a result of traffic flows along each link, and an assessment of the significance of any noise change.

13.6 Baseline Conditions

In order to discuss baseline conditions and the impacts of the scheme on the surrounding environment, the proposed scheme has been delineated into 16 sections. The sections of the scheme for the purpose of the noise assessment only are depicted in **Drawing A8-S3-3500, Appendix H, ES Volume II** of this report.

13.6.1 Predicted Baseline Noise Conditions

Baseline conditions were calculated based on predicted traffic flow data for the year 2016. The noise levels are reported below in the baseline noise bands stipulated in DMRB.

Section 1

The noise maps for the baseline scenario is shown in **Drawing A8-S3-3502, Appendix H, ES Volume II** The predicted baseline indicates that for road Section 1, between Ballyearl and Colman's Corner properties along the corridor of the A8 or the minor road networks are likely to be experiencing the highest noise levels in the region of 68.5 to 71.5dB(A). At around 150m from the axis of the A8 the noise level drops to 53.5 to 59.4dB(A).

Section 2

Along road Section 2 from Colman's Corner to Little Ballymena there are properties over 450m west of the existing A8 route that predicted to currently experience noise levels of under 47.5dB(A), most properties however are nearer to the A8 and are subject to noise levels of 47.5 to 53.5dB(A). Again along the corridor of the existing A8 route and other neighbouring roads there are properties that are predicted to experience up to 69.5dB(A).

Section 3

Section 3 of the scheme passes between Little Ballymena through an area known as Drumadowney Hill to the new junction for Calhame. Most residential properties are to the west of this section. Properties closest to the road would currently be subject to a noise level of 62.5 to 65.5dB(A) and those further than 200m from the axis of the existing A8 road are typically subject to a noise level between 47.5 to 53.5dB(A).

Section 4

Road Section 4 stretches from the new junction for Calhame to the new junction for Ballynure. There are properties situated close to the existing A8 that are predicted to current experience noise levels of 62.5 to 65.5dB(A). Most properties have been predicted to be subject to noise levels between 47.5 to 50.5dB(A). There are properties further west that are predicted to experience similar noise levels due to the existing A57. The settlement to the west of Millvale is predicted to be subject to noise levels in the region of 47.5 to 53.5dB(A).

Section 5

The area that is immediately adjacent to the new Ballynure junction, labelled Section 5, has noise sensitive properties to the south-east that will be subject to a noise level of 47.5 to 53.5dB(A). To the west of the existing junction there are properties that are predicted to currently experience a noise levels as high as 68.5 to 77.5dB(A).

Section 6

Section 6 is the main section of the Ballynure bypass. To the south-east there is a residential development with properties that border the existing A8 route that are predicted to be subject to noise levels of up to 71.5dB(A). The noise levels currently are predicted to drop to 50.5dB(A) at approximately 150m into the development. To the north west there is another residential development properties closest to the existing A8 route are predicted to be subject to a noise level ranging from 59.5 to 71.5dB(A) at distances greater than 200m the noise levels range from 50.5 to 56.5dB(A). At distances greater than approximately 300m the current predicted noise levels do not contain contributions from local road networks, this is because the modelling method does not predict road noise levels for traffic flows below 1000 AAWT18hr.

Section 7

Properties close to Section 7 between Ballyboley Bridge and Jamesons Moor are predicted to be subject to noise levels between 62.5 to 71.5dB(A). Just less than 400m from the axis of the A8 the current noise level is predicted to drop to below 50.5dB(A).

Section 8

Section 8 extends 500m north along the A8 from Ballybracken. There are properties to the east and west that are currently predicted to be subject to between

56.5 to 68.5dB(A), less than 250m from the existing A8 noise levels reduce to 47.5 to 50.5dB(A).

Section 9

Section 9 is to the north-west of an area known as Spennin Hill. Here there are properties closest to the existing A8 that are currently predicted to be subject to noise levels between 65.5 to 71.5dB(A). To the west by approximately 150m, the noise levels reduce to 50.5 to 53.5dB(A).

Section 10

Between Spennin Hill and Chapel Bridge is Section 10. Typically properties that border onto the existing A8 are currently predicted to be subject to noise levels in the range of 50.5 to 65.5dB(A). Mid way along this section there are properties currently predicted to experience up to 71.5dB(A). Most properties are subject to noise levels between 50.5 and 56.5dB(A). To the south-east noise levels reduce to below 47.5dB(A) at approximately 600m from the axis of the existing A8.

Section 11

Section 11 passes an area known as Craiginorne, there are properties to the west of this road section that are currently predicted to be subjected to noise levels between 56.5 and 59.5dB(A). Some of these properties border onto a minor road network, these noise levels are a result of contributions from both the A8 and the minor road. To the west the current noise level is predicted to reduce to below 50.5dB(A) approximately 200m from the axis of the existing A8 and to the east noise levels reduce to this level over approximately 400m.

Section 12

To the north-west of an area known as Stewartstown just before Ballyrickard Bridge is Section 12. To the east of this section there are properties near to the existing A8 route that are currently predicted to be subject to noise levels up to 65.5dB(A). To the south-east there is a group of properties that are currently predicted to be subject to noise levels of 50.5 to 59.5dB(A). Approximately 350m to the south-east from the existing A8 road axis the noise levels are currently predicted to reduce to less than 50.5dB(A).

Section 13

From Ballyrickard Bridge to the existing cross roads at Ballyedward is Section 13. Close to the Ballyedward junction there are several properties are currently predicted to be subject to noise levels between 69.5 to 74.5dB(A). Typically noise levels range from 50.5 to 59.5dB(A). To the east the current predicted noise level drops to less than 50.5dB(A) at distances greater than 300m from this section of the existing A8.

Section 14

Road Section 14 lies between the existing cross roads and the new round about layout at Ballyedward. There are properties to the south-east of this section that are currently predicted to be subject to 62.5 to 68.5dB(A). The current noise level drops to less than 50.5dB(A) at distances greater than 300m.

Section 15

The final section from the Ballyedward roundabout to the northern edge of the scheme assessment area is Section 15. There are properties close to the existing A8 to the east of this section that are currently predicted to be subject to noise levels up to 68.5dB(A). There are properties near to the Ballyedward roundabout that are currently predicted to experience noise levels in the range of 56.5 to 65.5dB(A). To the north-west there are properties over 700m away from the existing A8 route that are currently predicted to experience 47.5 to 53.5dB(A). Beyond the Ballyedward roundabout there are properties to the north-west of this section that border the existing A8 that are currently predicted to be subject to noise levels in the range of 62.5 to 68.5dB(A). There are also two settlements and a community further north-west where the current predicted noise levels are typically in the range of 47.5 to 53.5dB(A).

Section 16

Section 16 is a link from the A8 at Owen's Bridge due south-east. The current predicted noise levels at properties that border this link range from 53.5 to 59.5dB(A).

13.6.2 Baseline Noise Survey

A baseline noise survey was carried out between 11th and 13th May 2010 to establish existing noise levels at sensitive locations within 600m of the proposed scheme. This is recommended as part of the DMRB Detailed assessment procedure (para 4.3) to provide '*a broad understanding of the noise climate*'. The guidance also notes that:

'*During the assessment process, measurements should not routinely be compared with calculations for the purpose of predicting changes in noise level. There is currently no methodology available to take account of the potential errors associated with comparing measurements with calculations, especially when the receptor is some distance from the noise source.*'

The measurement methodology and results are detailed in the Baseline survey report in **Appendix H, ES Volume II**. It should be noted that, even where the noise climate is dominated by roads, some variance between existing measured noise levels and predicted noise levels for the future baseline year prior to opening of the scheme would be expected. This might be due to differences in traffic flow levels between the present and the baseline year or meteorological conditions at the time of the survey.

Measurements were made at 16 locations within the scheme assessment area along the route of the proposed road scheme. It was concluded that the noise climate at these locations was dominated by traffic noise typically with noise from the A8 and the A57.

The purpose of this exercise was to provide data on noise climates at a sample of locations to supplement the traffic noise prediction results but also to provide additional baseline data for the construction noise assessment. These site investigations are also considered important to determine if any parts of the study area are dominated by noise from sources other than traffic noise, in which case the prediction results would not accurately reflect noise levels in that area.

The measured results generally show a reasonable level of agreement with the predicted baseline traffic noise levels, given the expected range of variance for short-term survey results. In the few cases where larger differences occurred, there were reasons that the survey data was considered to be less reliable than the predicted data rather than indicating any error in the prediction model.

13.7 Assessment of Effects due to Construction

13.7.1 Construction Noise (Construction Plant)

For the purposes of the construction noise assessment, activities can generally be divided into two categories (linear and static). The construction activities, site clearance, earthworks and pavement including central reserve barrier installation can be viewed as an intense activity of work over a short timescale (less than one month) at a given location. Typically works are unlikely to be in the same vicinity for more than a few days at a time.

These activities are essentially linear processes, which gradually move along the alignment of the proposed scheme. Whilst it would be envisaged that each activity would follow on one after the other, it is considered that they would be staggered, so as not to be a contiguous process, following on directly one after another. These short-duration linear works are generally likely to be not significant in terms of noise effects.

In addition, a proportion of the construction activity will include what can be described as ‘static’ works, such as new or altered junctions, major earthworks and retaining walls (structures). These construction processes involve concentrated activities in relatively localised areas for considerable periods of time (more than one month).

Wherever these large, more complex constructions are required, the resultant noise effects are more likely to be significant. In such cases in particular, construction methodologies should be made as efficient as possible to minimise noise impacts to local residential areas.

In places where screening is recommended as part of the traffic noise mitigation plan, the early installation of these screening measures, where practicable, would also reduce the construction noise levels considerably.

Locations closest to the scheme are likely to be subject to the highest construction noise levels, although this will depend on topography and existing infrastructure providing natural screening. The level of impact would also vary considerably, dependent on the current ambient noise levels for given areas. Where properties are already subject to significant road traffic noise, the impact from construction noise will be less than those areas which are set further back from existing road transport corridors, where the new route detours away from the current mainline road alignments.

Table 73 and Table 74 give the estimated construction noise levels for the following construction activities; structures only and structures plus earthworks. Noise levels have been estimated using the established methodologies described in chapter 13.4.4. The duration of these construction activities have been considered to last more than one month. Noise levels have also been estimated for two possible screened conditions, partial screening (estimated noise level less 5dB) and full screening (estimated noise level less 10dB). Table 73represents the worst-case and Table 74 the typical case construction works for Section 2 of the proposed scheme. This refers to Section 2 as designated by the construction contractor (see **Drawing A8-S3-3501, Appendix H, ES Volume II**).

Table 75 and Table 76 give the estimated construction noise levels for the pavement works only and cumulative noise levels for site clearance, drainage / lighting and pavement works. The duration of these construction activities have been considered to typically last less than one month in any one location, although earthworks and structural works associated with junctions in this section may last longer than one month. Again noise levels have also been estimated for two possible screening conditions, partial screening (estimated noise level less 5dB) and full screening (estimated noise level less 10dB). In addition to this, comparisons of the estimated construction noise with the baseline ambient noise levels have been made.

Table 75 represents the worst-case and Table 76 represents the typical case construction works for Section 3 of the proposed scheme.

Table 73 **Worst-Case construction noise levels in dB(A) for Section 2**

	$L_{Aeq,10hr}$ at 50m	$L_{Aeq,10hr}$ at 100m	$L_{Aeq,10hr}$ at 150m	$L_{Aeq,10hr}$ at 200m	$L_{Aeq,10hr}$ at 300m	$L_{Aeq,10hr}$ at 400m	$L_{Aeq,10hr}$ at 500m
Structures works only	72	66	62	60	56	54	52
With partial screening	67	61	57	55	51	49	47
With full screening	62	56	52	50	46	44	42
Structures + Earthworks	80	74	71	68	65	62	60
With partial screening	75	69	66	63	60	57	55
With full screening	70	64	61	58	55	52	50
Key	Exceeds noise significance threshold						
	Noise level below daytime noise significance threshold <65dB(A)						
	Noise level below daytime and evening noise significance threshold <55dB(A)						

	Noise level below daytime, evening and night-time noise significance threshold <45dB(A)

Predicted noise levels for structures only construction works along Section 2 of the proposed scheme range from 52dB(A) at over 500m from the works to 72dB(A) at 50m from the works.

These noise levels were calculated assuming that there is no screening from topography or other existing structures and hence the noise sensitive receiver (NSR) has a clear line of sight to the construction activity.

In accordance with the assessment criteria set out in BS5228 (2009), see chapter 13.4.6, for construction activities lasting more than one month that daytime activity noise levels <65dB(A) at the NSR are considered not a significant effect. Similarly evening construction activity noise levels of <55dB(A) and night-time construction noise levels of <45dB(A) are considered not to be a significant effect.

Table 73 above indicates that for daytime noise levels from worst-case constructions, only construction activities at distances over 150m from NSRs are rated as not significant. Equally, at over 400m from the same construction activity, evening noise levels are predicted to be <55dB(A) and hence not considered significant.

Table 73 also shows predicted noise levels from the same construction activity with partial screening and full screening. It also indicates whether the resulting noise levels exceed the significance threshold for daytime, evening, and night-time. Note that with partial screening structures, construction works exceed the daytime noise level threshold at distances up to 50m from the construction works.

There are no dwellings within 50m of Section 2 of the scheme construction works hence construction noise is considered not significant. It should be noted that there are eight dwellings situated between 50m and 100m from this section of construction works that are likely to experience noise level changes that exceed the criteria of significance of >5dB. In this instance the construction noise would be considered significant.

Table 74 **Typical construction noise levels in dB(A) for Section 2**

Construction Activity	$L_{Aeq,10hr}$ at 50m	$L_{Aeq,10hr}$ at 100m	$L_{Aeq,10hr}$ at 150m	$L_{Aeq,10hr}$ at 200m	$L_{Aeq,10hr}$ at 300m	$L_{Aeq,10hr}$ at 400m	$L_{Aeq,10hr}$ at 500m
Structures works only	69	63	60	57	54	51	49
With partial screening	64	58	55	52	49	46	44
With full screening	59	53	50	47	44	41	39
Structures + Earthworks	78	72	68	66	62	60	58
With partial screening	73	67	63	61	57	55	53
With full screening	68	62	58	56	52	50	48
Key	Exceeds noise significance threshold						
	Noise level below daytime noise significance threshold <65dB(A)						
	Noise level below daytime and evening noise significance threshold <55dB(A)						
	Noise level below daytime, evening and night-time noise significance threshold <45dB(A)						

Table 74 shows estimated typical case construction noise levels for the structures plus earthworks along Section 2 of the proposed scheme. The results range from 60dB(A) at over 500m from the works to 80dB(A) at 50m from the works.

The predicted construction noise levels indicate that for daytime, noise levels from structures plus earthworks activities at distances over 400m from NSRs are <65dB(A) and hence not significant. Predicted noise levels from the same construction activity with partial screening do not exceed the daytime significance threshold at NSRs at distances over 200m and are therefore not considered significant. With full screening, resulting noise levels do not exceed the significance threshold for daytime at distances over 100m, and at over 300m do not exceed the significance threshold for evening and are not considered significant. Note that with full screening structures plus earthworks, construction activities exceed the daytime significance threshold at distances up to 50m from the construction works.

Again there are no dwellings within 50m of Section 2 of the A8 dualling, construction works hence construction noise is considered not significant. However it should be noted that there are 8 dwellings situated between 50m and 100m from this section of construction works. These dwellings may experience noise level changes that exceed the criteria of significance of >5dB. In this instance the construction noise would be considered significant.

Table 75 **Worst-Case construction noise levels in dB(A) for Section 3**

Construction Activity	**$L_{Aeq,10hr}$ at 50m**	**$L_{Aeq,10hr}$ at 100m**	**$L_{Aeq,10hr}$ at 150m**	**$L_{Aeq,10hr}$ at 200m**	**$L_{Aeq,10hr}$ at 300m**	**$L_{Aeq,10hr}$ at 400m**	**$L_{Aeq,10hr}$ at 500m**
Pavement works only	72	66	62	60	56	54	52
With partial screening	67	61	57	55	51	49	47
With full screening	62	56	52	50	46	44	42
Site clearance, Drainage/Lighting, + Pavement works	80	74	71	68	65	62	60
With partial screening	75	69	66	63	60	57	55
With full screening	70	64	61	58	55	52	50
Key	Exceeds noise significance threshold						
	Noise level below daytime noise significance threshold <65dB(A)						
	Noise level below daytime and evening noise significance threshold <55dB(A)						
	Noise level below daytime, evening and night-time noise significance threshold <45dB(A)						

The type of construction activities assessed in Table 75 and Table 76 are considered to be short term construction activities lasting less than one month. These construction activities are less likely to result in significant effects. In addition, the earthworks and structures associated with certain junctions on this section may require construction activities lasting longer than one month.

Table 76 shows the estimated worst-case construction noise levels for the pavement only works along Section 3 of the proposed A8 dualling. The predicted noise levels range from 52dB(A) at over 500m from the works to 72dB(A) at 50m from the works.

Predicted construction noise levels indicate that for daytime, noise levels from pavement only activities at distances over 150m from NSRs are <65dB(A) and hence not significant. Predicted noise levels from the same construction activity with partial screening do not exceed the daytime significance threshold at NSRs at distances over 100m and are therefore not considered significant.

With full screening the resulting noise levels do not exceed the significance threshold for daytime at distances over 50m. At over 150m predicted construction noise levels for pavement only works do not exceed the significance threshold for evening and are not considered significant.

The predicted worst-case cumulative construction noise levels from site clearance, drainage/lighting and pavement works for daytime range from 60dB(A) at over 500m to 80dB(A) at distances less than 50m from the construction works.

Predicted cumulative construction noise levels indicate that for daytime, noise levels at distances over 300m from NSRs are <65dB(A) and hence not significant. Predicted noise levels from the same cumulative construction activities with partial screening do not exceed the daytime significance threshold at NSRs at distances over 200m and are therefore not considered significant.

With full screening the predicted noise from cumulative construction activities exceed the daytime significance threshold at distances up to 50m from the construction works. There are approximately 20 dwellings within 50m of Section 3 of the A8 dualling construction works hence construction noise would be considered significant.

There are approximately a further 35 dwellings situated between 50m and 100m from Section 3 of the construction works that may experience noise level changes that exceed the criteria of significance of >5dB. In this instance the construction noise would be considered significant.

Table 76 **Typical construction noise levels in dB(A) for Section 3**

Construction Activity	**$L_{Aeq,10hr}$ at 50m**	**$L_{Aeq,10hr}$ at 100m**	**$L_{Aeq,10hr}$ at 150m**	**$L_{Aeq,10hr}$ at 200m**	**$L_{Aeq,10hr}$ at 300m**	**$L_{Aeq,10hr}$ at 400m**	**$L_{Aeq,10hr}$ at 500m**
Pavement works only	69	63	60	57	54	51	49
With partial screening	64	58	55	52	49	46	44
With full screening	59	53	50	47	44	41	39
Site clearance, Drainage/Lighting, + Pavement works	78	72	68	66	62	60	58
With partial screening	73	67	63	61	57	55	53
With full screening	68	62	58	56	52	50	48
Key	Exceeds noise significance threshold						
	Noise level below daytime noise significance threshold <65dB(A)						
	Noise level below daytime and evening noise significance threshold <55dB(A)						
	Noise level below daytime, evening and night-time noise significance threshold <45dB(A)						

Table 76 shows the estimated typical construction noise levels for the pavement only works along Section 3 of the proposed scheme. The predicted noise levels range from 49dB(A) at over 500m from the works to 69dB(A) at 50m from the works.

Predicted construction noise levels indicate that for daytime, noise levels from pavement only activities at distances over 150m from NSRs are <65dB(A) and hence not significant. Predicted noise levels from the same construction activity with partial screening do not exceed the daytime significance threshold at NSRs at distances over 100m and are therefore not considered significant.

With full screening the resulting noise levels do not exceed the significance threshold for daytime at distances over 50m. At over 150m, predicted construction noise levels for pavement only works do not exceed the significance threshold for evening and at over 400m typical construction noise levels for pavement only works do not exceed the significance threshold for night-time and would subsequently be considered not significant.

The predicted typical case cumulative construction noise levels from site clearance, drainage/lighting and pavement works for daytime range from 58dB(A) at over 500m to 78dB(A) at distances less than 50m from the construction works.

Predicted cumulative construction noise levels indicate that for daytime, noise levels at distances over 300m from NSRs are <65dB(A) and hence not significant. Predicted noise levels from the same cumulative construction activities with partial screening do not exceed the daytime significance threshold at NSRs at distances over 200m and are therefore not considered significant.

With full screening the predicted noise from cumulative construction activities exceed the daytime significance threshold at distances up to 50m from the construction works. There are approximately 20 dwellings within 50m of Section 3 of the proposed scheme construction works hence construction noise would be considered significant.

There are approximately a further 35 dwellings situated between 50m and 100m from Section 3 of the construction works that may experience noise level changes that exceed the criteria of significance of >5dB. In this instance the construction noise would be considered significant.

All measures to minimise construction noise would be taken according to best practicable means, as described in the mitigation measures section.

13.7.2 Construction Noise (Construction Traffic)

DMRB (2009) indicates that an increase in traffic flow by at least 25% or decrease by 20% is equivalent to a change in noise level of 1dB(A). The cumulative traffic flow calculated from the sum of construction traffic and workforce traffic increases the road traffic flow along each of the three construction sections by less than 25%. It is therefore considered that noise from construction related traffic flow would not be significant.

13.8 Mitigation of Effects due to Construction

The following sections describe the measures proposed to address any significant effects identified in the assessment.

13.8.1 Mitigation and Offsetting of Effects due to Construction Noise

General principles of construction site noise control would be followed according to the guidance given in BS 5228(2009). This requires that noise control measures would be adopted according to ‘Best Practicable Means’ (BPM) which includes measures such as specification of plant equipment, hours of operation and HGV access routes. Specific noise control practices could be agreed between the Contractor and the Local Authority if appropriate.

Should hoarding be erected, it should be placed to break the line of sight between the receiver and the construction works. In order to be effective at screening noise, the hoarding material will have a mass per unit of surface area in excess of 7 kg/m². Plywood sheets attached to a suitable scaffold frame are often used to create temporary screening for this purpose. If appropriate further screening will also be used to provide additional screening around long-term static plant (e.g. generators) at locations where the boundary screening might not be effective such as areas of raised ground where there might be a clear line of sight between source and receiver.

Plant machinery such as generators or compressors will be positioned as far from noise sensitive locations as possible and ideally in naturally screened positions. All plant equipment will be adequately maintained to minimise noise emission.

13.9 Residual Effects due to Construction

Although there will not be long term residual effects from construction works. It is likely that at some locations predicted noise levels may not be fully mitigated by the provision of full screening. For construction activities lasting more than one month where noise levels exceed the BS5228 (2009) noise level criteria stated in chapter 13.4.6 would be considered temporary residual effects.

13.10 Assessment of Effects due to Operation (Traffic Noise)

This section is concerned with the assessment of changes to the existing noise climate as a direct result of the proposed scheme. This assessment has been performed in accordance with the DMRB assessment procedure. Following the description of the assessment of changes to noise levels due to the proposed scheme in chapter 13.10.1.1 this section includes:

- Details of the impacts and effects of the scheme with respect to changes to the existing noise climate (chapter 13.10.2);
- A section (chapter 13.10.3) that details the impacts and effects on roads beyond 2km of the scheme; and
- Chapter 13.10.5 which is concerned with the potential noise nuisance assessment that is a requirement of the DMRB assessment.

The summary tables in chapter 13.10.5 quantify the numbers of properties subject to increases and decreases and the associated magnitude of the noise changes. The associated estimated nuisance changes are also quantified in terms of the number of dwellings affected.

Chapter 13.10.5) details the results of the noise insulation regulations (NIR) assessment, for details of these regulations see chapter 13.2.4.

13.10.1.1 Operational Noise Assessment

Predicted traffic noise levels for the Do Something scenarios; opening year (2016) and the future year (2031) have been represented in noise level contour maps; see **Drawings A8-S3-3503 to 3504, Appendix H, ES Volume II**.

The DMRB procedure primarily assesses the short term and long term impacts arising from the proposed scheme relative to the baseline noise climate.

Therefore, the assessment of the magnitude of noise change impact (Table 12.2) has been made based on changes in the noise climate between baseline year without the scheme (2016) and the opening year (2016) with scheme and baseline year without the scheme (2016) and worst-case future year (2031) with the scheme.

Subsequently an assessment of the long term effects have been made based on changes in the noise climate between baseline year without the scheme (2016) and worst-case future year (2031) with the scheme. This describes whether the noise effects in an area affected by the scheme are rated as significant or not based on the criteria described in chapter 13.4.8. In summary, the assessment of significance of noise effects is based on the size of the community affected, the impact magnitude and the existing noise climate.

Noise level difference maps, **Drawings A8-S3-3505 and 3506, Appendix H, ES Volume II** show the changes in the noise climates between the Do Something scenarios for years 2016 and 2031and Do Minimum scenario 2016.

13.10.2 Assessment of Noise Level Changes between Do Something and Do Minimum Scenarios

This section considers the impact magnitude of the opening year (2016) and the future year (2031). The assessment of significance is based on the longer term change arising from the impact of the future year scenario.

Additionally, the number of properties adjacent to each road section identified as eligible for noise insulation in accordance with the Noise Insulation Regulations (chapter 13.2.4 above) and generally termed 'NIR qualifiers' have been stated. The full NIR eligibility assessment is detailed in chapter 13.10.5.

Section 1

The noise level difference map shows that for road Section 1, between Ballyearl and Colman's Corner, that noise sensitive dwellings within the scheme assessment area would be subject to a noise level increase of less than 1dB during the opening year (2016) rising to up to 1dB by the future year (2031). This would be rated as a negligible impact and assessed as a ***not significant effect***. No dwellings have been identified as NIR qualifiers.

Section 2

Along road Section 2 from Colman's Corner to Little Ballymena there is a group of residential dwellings and a Sunday School to the west of the new bypass that will experience a reduction in noise level greater than 5dB during the opening year, which equates to a major beneficial impact. This level of noise decrease remains the same in the future year. This decrease in noise level would be rated as a major beneficial impact and assessed as a ***significant positive effect*** for this community. There are three noise sensitive properties near the new bypass that are predicted to be subject to an increase in noise level greater than 5dB. This level of increase is predicted for the opening year and the future year. During the opening year this level of increase would be rated as a major adverse impact. In the future year this would also be rated as a major adverse impact and assessed as ***unlikely to be significant*** to this area given the small number of scattered properties affected, not all of which are residential dwellings. However one of these properties has been identified as an ***NIR qualifier***, as the noise level is predicted to increase sufficiently to meet the NIR criteria.

Section 3

Section 3 of the scheme passes between Little Ballymena through an area known as Drumadowney Hill to the new junction for Calhame. There are a group of 3 dwellings to the west of the alignment, two of which were predicted to be subject to a noise level increase of 3 to 5dB, rising to all three dwellings in the future year. For both the opening year and future year this would be rated as a moderate adverse impact, and would be assessed as ***unlikely to be significant*** as the noise level increase only affects two isolated dwellings. There also dwellings further to the north where noise level changes of 3 to 5dB are predicted. This would be rated as a moderate adverse impact, but assessed as unlikely to be significant due to the scattered nature of these dwellings.

Due to the level of the prevailing noise climate at this location a total of four dwellings have been identified as ***NIR qualifiers***.

Section 4

Road Section 4 extends from the new junction for Calhame to the new junction for Ballynure. Opening year predictions indicate that properties adjacent to this road section would be subject to a noise level increase up to 1dB this would be rated as a negligible impact. For the future year the same properties would be subject to a 1 to 3dB this would be rated as a minor adverse impact and assessed as a ***not significant effect***. None of the properties adjacent to this road section were identified as NIR qualifiers.

Section 5

The area immediately adjacent to the new Ballynure junction is labelled Section 5. At opening year, properties to the south-east are predicted to be subject to a decrease in noise levels by greater than 5dB which would be rated as a major beneficial impact. Similarly in the future year the noise level decrease is predicted to be greater than 5dB and also rated as a major beneficial impact, these properties are not residential and the effect would be assessed as ***unlikely to be significant***.

Section 6

Section 6 is the main section of the Ballynure bypass. The closest dwellings to both the east of this road section at Ballynure and to the north-west at the Millikenstown area will be subject to noise level increases greater than 5dB during both the opening year and the future year. For both these communities this would be rated as a major adverse impact and for the future year assessed as a ***significant effect*** given the numbers of dwellings affected and the level of noise change in these communities. Noise level changes at the Church of Ireland Church and parish hall are predicted to be between 3 to 5dB, this would be rated as a moderate adverse impact and assessed as ***unlikely to be significant***. To the east of the proposed bypass section where the existing A8 road is aligned, there are a number of dwellings and a Primary School that would experience a decrease in noise level between 1 to 3dB. Further to this there are a large number of dwellings that border the existing A8 route where decreases greater than 5dB are predicted. These decreases in noise level would be assessed as minor beneficial and major beneficial impacts respectively. For the future year, minor beneficial impacts would be assessed as ***unlikely to be significant*** and for those dwellings experiencing major beneficial impacts would be assessed as being subject to

significant positive effects. No properties adjacent to this road section were identified as NIR qualifiers.

Section 7

To the east of Section 7 between Ballyboley Bridge and Jamesons Moor there is one dwelling where an increase of 3 to 5dB is predicted in the opening year, rising to a greater than 5dB increase in the future year. This would be rated as major adverse impact. The assessment of the significance for the future year however would be ***unlikely to be significant*** as this is the only dwelling in this area affected by this level of noise impact. However, due to the noise level predicted at this location, one dwelling has been identified as an ***NIR qualifier***.

Section 8

Section 8 extends 500m north along the A8 from Ballybracken. For the opening year and the future year there are three dwellings to the east that are predicted to be subject to 3 to 5dB increases in noise level, this would be rated as a moderate adverse impact. These few dwellings are isolated, and for the future year would be assessed as ***unlikely to be significant***. Adjacent to this road section, two dwellings have been identified as ***NIR qualifiers***.

Section 9

To the east of Section 9 (Spennin Hill) there is one dwelling that would be subject to an increase in noise level greater than 5dB, this would be rated as a major adverse impact. There are other nearby dwellings to the west that are predicted to experience increases in noise levels between 3 to 5dB. The noise level increases would be rated as moderate adverse impact. These impacts are predicted to occur during the opening year and the future year. Given the noise level increase, the number of dwellings and the relatively high noise level experienced by these properties for the future year, this has been assessed as a ***significant effect***. A total of four dwellings have been identified as ***NIR qualifiers***.

Section 10

To the east of Section 10 (between Spennin Hill and Chapel Bridge) there are a small number of dwellings and a school predicted to be subjected to noise level increases of between 1 to 3dB. This increase occurs for both the opening year and the future year predictions and would be rated as minor adverse impact and for the future year only be assessed as ***unlikely to be significant***. There are a small number of dwellings to the west of the proposed scheme which are predicted to be subject to an increase of 3 to 5dB in the future year, this would be rated as a moderate adverse impact on this area, and considered ***unlikely to be significant*** due to the number and scattered nature of these dwellings**.** There were two dwellings identified as ***NIR qualifiers*** adjacent to this road section due to the predicted level of noise from the proposed scheme exceeding the NIR noise threshold.

Section 11

Section 11 passes an area known as Craiginorne; there are isolated and scattered dwellings to the east of this road section that are subject to a noise level increase of 3 to 5dB during both the opening year and the future year. This noise level increase would be rated as a moderate adverse impact and for the future year assessed as ***unlikely to be significant***. To the west there are dwellings that border the existing A8 route that are predicted to experience a noise level decrease of between 1 to 3dB again for both the opening year and the future year, this decrease in noise level would be rated as minor beneficial impact and for the future year would be assessed as ***unlikely to be significant***. Adjacent to this road section no properties were identified as NIR qualifiers.

Section 12

To the north-west of an area known as Stewartstown just before Ballyrickard Bridge is Section 12. To the east and the west of this road section there are dwellings subject to a noise level increase of 1 to 3dB. This level of noise increase occurs for both the opening year and future year predictions and would be rated as a minor adverse impact and for the future year be assessed as ***unlikely to be significant***. Three scattered dwellings in different areas are subject to an increase of 3-5dB, this would be rated as a moderate adverse impact and assessed as ***unlikely to be significant***. However, a single dwelling has been identified as an ***NIR qualifier*** adjacent to this road section.

Section 13

From Ballyrickard Bridge to the existing cross roads at Ballyedward is Section 13. To the east of this section there are dwellings that are predicted for both the opening year and the future year to be subject to a noise level increase of 1 to 3dB. This noise level increase is rated as minor adverse impact and for the future year would be assessed as ***unlikely to be significant***. To the west of this section again for both the opening year and the future year, there are two dwellings predicted to be subject to a 3 to 5dB increase in noise level which is rated as moderate adverse impact and for the future year would be assessed as ***unlikely to be significant*** as it affects only two isolated dwellings in this area. There are however dwellings that border this road section that are subject to sufficiently high noise levels that in total four dwellings are considered ***NIR qualifiers***.

Section 14

Road Section 14 lies between the existing cross roads and the new roundabout layout at Ballyedward. To the south-east of this section where the new road layout joins the existing road layout there is a dwelling subject to an increase in noise level of 3 to 5dB. This level of noise change is predicted to occur in both the opening year and the future year. Although this would be rated as moderate adverse impact for both the opening year and the future year, there is only one dwelling affected by the new road layout, hence this would be assessed as ***unlikely to be significant***. No properties adjacent to this road section were identified as NIR qualifiers.

Section 15

The final section from the Ballyedward roundabout to the northern edge of the scheme assessment area is Section 15. There are dwellings to the east and west of this road section that are subject to a noise level changes of -1 to 1dB, these changes occur in both the opening year and future year and would be rated as a negligible impact and for the future year would be assessed as a ***not significant effect***. However one closest to this road section has been identified as an ***NIR qualifier***.

Section 16

Section 16 is a link from the A8 at Owen's Bridge due south-east. There are dwellings to the north-east of this section that would be subject to a noise level increase in the range of 1 to 3dB which would be rated as a minor adverse impact for both the opening year and future year. For the future year this would be assessed as ***unlikely to be significant***. No properties adjacent to this road section were identified as NIR qualifiers.

13.10.2.1 Assessment of Noise Levels at Lower Ballyboley Road

The assessment has identified the number of sensitive receivers within 50m of the Lower Ballyboley Road, and the average distance to these receivers. The tables show the AAWT18hr flow (with an asterisk where flows have been rounded up to 1000), and the corresponding overall noise level in dBL_{A10}.

Lower Ballyboley Road – Lismenary Road to Junction Lane Link

There are 16 sensitive receivers within 50m of this link. The average distance to road centreline (for receivers within 50m of the link) is 27m.

Table 77 **AAWT18hr flow and overall noise level in dBL_{A10} for Lismenary Road to Junction Lane Link**

Scenario	DM2016	DM2031	DS2016	DS2031
AAWT 18hr flow	1000	1000	1000	1086
Overall noise level (dBL_{A10})	54.4	54.4	54.4	54.8

Lower Ballyboley Road – Junction Lane to Moss Road Link

The number of sensitive receivers within 50m is 6. The average distance to road centreline (for receivers within 50m of the link) is 17m.

Table 78 **AAWT18hr flow and overall noise level in dBL_{A10} for Junction Lane to Moss Road Link**

Scenario	DM2016	DM2031	DS2016	DS2031
AAWT 18hr flow	1000	1102	1000	1086
Overall noise level(dBL_{A10})	55.5	56.1	55.5	56.1

Lower Ballyboley Road – Minor Road to Moss Road Link

Number of sensitive receivers within 50m - 3

Average distance to road centreline (for receivers within 50m of the link) - 27m

Table 79 **AAWT18hr flow and overall noise level in dBL_{A10} for Minor Road to Moss Road Link**

Scenario	DM2016	DM2031	DS2016	DS2031
AAWT18hr flow	1000	1000	1000	1137
Overall noise level(dBL_{A10})	54.4	54.3	54.3	55.0

When the Do Minimum Opening Year and Do Something Future Year scenarios are compared, noise increases as a result of the scheme are predicted to be between +0.4dB to +0.6dB. It is anticipated that this increase will occur at at least 25 sensitive receivers along Lower Ballyboley Road. Small noise changes of this magnitude are rated as ***unlikely to be significant*** according to criteria in chapter 13.4.7.

13.10.3 Assessment of Affected Routes Beyond 2km from the Scheme

An assessment of Basic Noise Level (BNL) has been carried out for dwellings beyond 2km of the proposed scheme. Affected links are unaltered existing roads that are predicted to experience changes in noise level as a result of the proposed scheme of 1dB or more. Affected links have been identified outside the eastern edge of the scheme assessment area along Mounthill Road and Ballysnod Road. The two links are shown in **Drawings A8-S3-3507 in Section H2 of Appendix H, ES Volume II.**

The changes in baseline noise level around link 1, were predicted to be between 0 to 1dB increase during the opening year rising to 1 to 3dB during the future year. Within 50m of link 1 there are 16 dwellings. For the opening year the increase in noise level would be rated as negligible impact. For the future year the noise level increase would be rated as a minor adverse impact and assessed as ***unlikely to be significant***.

Changes to the baseline noise level close to link 2, were predicted to be a -1 to 1dB during the opening year rising to -3 to 3dB during the future year. There are no properties within 50m of link 2. The changes in noise level within 50m of affected link 2 would be rated as negligible for the opening year and rated as minor adverse to minor beneficial impact and assessed as ***unlikely to be significant*** for the future year.

13.10.4 Assessment of Night-time Noise

DMRB states that an assessment of night-time noise should be considered when the night-time noise level is expected to be less than 10dB below the daytime noise level (DMRB Vol.11 Sec.3 Part.7 paragraph 3.45 v.). Previously undertaken counts of traffic flow show that night time (00:00 – 06:00) weekday flow on the existing A8 alignment are approximately 5% of the daytime (06:00 – 00:00) weekday flow or less. This would suggest that current night-time road traffic noise levels are more than 10dB below the existing daytime level.

Although the proposed scheme is designed to increase capacity on the A8 between Belfast and Larne, it is not expected that there will be a significant change in the nature of the traffic on the new dualled A8. As such, it is expected that the proportion of daytime to night-time traffic flows will remain largely unchanged from the current levels as a result of the scheme, and that night-time noise levels will remain at least 10dB below daytime noise levels.

13.10.5 Potential Noise Nuisance Assessment

As part of the DMRB Detailed Assessment ASTs showing changes in noise level and noise nuisance must be presented. The first table required presents the projected change in nuisance in the absence of the proposed scheme (by comparing the Do Minimum scenario in the design assessment year with the Do Minimum scenario in the baseline year). A second table is required showing the projected change in nuisance if the proposed scheme is implemented (by comparing the Do Something scenario in the design assessment year with the Do Minimum scenario in the baseline year).

The results of this analysis are shown in Table 80 and Table 81 respectively. The assessment is then carried out by reporting the difference in numbers of dwellings falling into each ‘change in noise’ category and the associated nuisance changes.

In this way, the impact of the Do Something scenario in 2031 is compared with the Do Minimum scenario in 2031 by comparing the result of the two tables. For example, if there were 100 dwellings in the 1-2.9dB noise increase category in the Do Minimum table and 110 in the Do Something table, an increase of 10 dwellings in this category would be reported.

The predicted noise level changes for the Do Minimum scenario in the design assessment year with the Do Minimum scenario in the baseline year are shown in Table 80.

It was predicted that a total of 1879 dwellings would be subject to noise levels increases of 0.1-0.9dB, a total of 29 dwellings would be subject to a noise level increase of 1-2.9dB and a total of 5 dwellings would experience a noise level increase of 3 to 5dB.

The noise level change predictions also show that a total of 26 dwellings would be subject to a noise level decrease of 0.1-0.9dB and 4 dwellings subject to a noise level decrease of 1-2.9dB.

This AST predicts the change in noise in the absence of the scheme showing the results of natural traffic changes over a fifteen year period between the baseline year 2016 and future year 2031. DMRB describes this assessment as the ‘steady state’ nuisance assessment method (i.e. in the absence of an abrupt change in traffic noise associated with a new or altered highway).

The results are described as a change in noise nuisance percentage points. The Do Minimum scenario results in increases in nuisance of <10% for 2006 dwellings, and decreases in nuisance of <10% for 32 dwellings. No dwellings are predicted to have changes in nuisance exceeding +10% or -10%.

The predicted noise level changes for the Do Something scenario in the design assessment year with the Do Minimum scenario in the baseline year are shown in Table 81.

It was predicted that a total of 559 dwellings would be subject to noise levels increases of 0.1-0.9dB, a total of 750 dwellings would be subject to a noise level increase of 1.0-2.9 dB, a total of 290 dwellings would experience a noise level increase of 3.0-4.9dB, and 230 dwellings would experience an increase of >5dB.

The noise level change predictions also show that a total of 72 dwellings would be subject to a noise level decrease of 0.1-0.9dB, 54 dwellings would be subject to a noise level decrease of 1.0-2.9dB, 28 dwellings would be subject to a noise level decrease of 3.0-4.9dB and 17 dwellings subject to a noise level decrease of >5dB.

In terms of noise nuisance percentage points this amounts to an increase of <10% for 182 dwellings, an increase of 10% - 20% for 576 dwellings, 20% - 30% for 680 dwellings, 30% - 40% for 344 dwellings and >=40% for 100 dwellings across the scheme assessment area. A decrease in noise nuisance of 0-10% occurs for 155 dwellings across the scheme assessment area.

It should be noted that AST, shows the results of the highest level of predicted nuisance between scheme opening and the future assessment year. The step-change in noise level that takes place at scheme opening gives the result that much higher levels of noise nuisance are predicted and hence it is this result that is reported. Over time, levels of noise nuisance gradually revert to the lower 'steady-state' scenario.

Comparing the differences between the Do Minimum scenario in Table 80 and the Do Something scenario in Table 81, the following conclusions can be drawn.

Without the proposed scheme a total of 1320 more dwellings would experience a noise level increase of 0.1-0.9dB due to natural traffic changes on the network.

With the proposed scheme, a total of 717 more dwellings would experience a noise level increase of 1-2.9dB, 285 more dwellings would experience a noise level increase of 3-4.9dB, and 230 more dwellings would experience a noise level increase of >5dB.

In respect to noise level decreases, with the proposed scheme, 46 more dwellings would experience a noise level decrease of 0.1-0.9dB, 50 more dwellings would experience a decrease in noise level of 1-2.9dB, 28 more dwellings would experience a decrease in noise level of 3-4.9dB, and 17 more dwellings would experience a decrease in noise level of >5dB.

Table 80 **Assessment Summary Table - Do Minimum Future year**

Change in noise/nuisance level future year (Do Minimum)		Number of dwellings (façade level noise band LA10,18h dB(A) for Do Minimum scenario in the baseline year)														
		Total	**< 47.5**	**47.5 - 50.4**	**50.5 - 53.4**	**53.5 - 56.4**	**56.5 - 59.4**	**59.5 - 62.4**	**62.5 - 65.4**	**65.5 - 68.4**	**68.5 - 71.4**	**71.5 - 74.4**	**74.5 - 77.4**	**77.5 - 80.4**	**80.5 - 83.4**	**>= 83.5**
Increase in noise level, LA10,18h dB(A)	**0-0.1**	89	16	12	4		2	3	3	47	2					
	0.1-0.9	1879	682	284	224	147	119	116	89	128	52	24	14			
	1-2.9	33	30	1				1	1							
	3-4.9	5	5													
	5+															
Decrease in noise level, LA10,18h dB(A)	**0-0.1**	2	1		1											
	0.1-0.9	26	12	4	5	4					1					
	1-2.9	4		2		1	1									
	3-4.9															
	5 +															
Increase in nuisance level, percentage points	**< 10**	2006	733	297	228	147	121	120	93	175	54	24	14			
	10 < 20															
	20 < 30															
	30 < 40															
	>= 40															
Decrease in nuisance level, percentage points	**< 10**	32	12	6	6	5	1	1			1					
	10 < 20															
	20 < 30															
	30 < 40															
	>= 40															

Table 81 **Assessment Summary Table - Do Something Future year**

Change in noise/nuisance level future year (Do Something)		**Number of dwellings (façade level noise band LA10,18h dB(A) for Do Minimum scenario in the baseline year)**														
		Total	**< 47.5**	**47.5 - 50.4**	**50.5 - 53.4**	**53.5 - 56.4**	**56.5 - 59.4**	**59.5 - 62.4**	**62.5 - 65.4**	**65.5 - 68.4**	**68.5 - 71.4**	**71.5 - 74.4**	**74.5 - 77.4**	**77.5 - 80.4**	**80.5 - 83.4**	**>= 83.5**
Increase in noise level, LA10,18h dB(A)	**0-0.1**	37	10	7	6	6	1	3	2	2						
	0.1-0.9	559	292	100	49	36	21	24	13	7	8	3	6			
	1-2.9	750	443	149	66	31	25	17	16	1	2					
	3-4.9	290	105	74	51	22	14	10	10	3	1					
	5+	230	53	47	58	22	18	9	11	6	2	1	3			
Decrease in noise level, LA10,18h dB(A)	**0-0.1**	1							1							
	0.1-0.9	72	31	9	8	7	7	4	5	1						
	1-2.9	54	39	2	1	7	5									
	3-4.9	28	27			1										
	5 +	17	12	3	1	1										
Increase in nuisance level, percentage points	**< 10**	182	59	30	23	15	11	17	8	6	6	2	5			
	10 < 20	576	361	97	39	32	17	13	9	4	2	1	1			
	20 < 30	680	359	142	73	33	33	18	18	2	2					
	30 < 40	344	116	95	65	25	11	12	11	4	3	1	1			
	>= 40	100	10	14	31	13	12	6	8	4			2			
Decrease in nuisance level, percentage points	**< 10**	155	107	13	8	15	7	1	4							
	10 < 20															
	20 < 30															
	30 < 40															
	>= 40															

13.10.6 Noise Insulation Regulations (NIR) Eligibility

In accordance with the NIR requirements, the noise assessment must identify residential properties within 300m of the proposed scheme that are subject to noise levels that meet or exceed NIR criteria (described in chapter 13.2.4).

The identified dwellings are listed in Table 82 against the road section to which they are adjacent. These dwellings are eligible for insulation and therefore consideration has been given to mitigation that would reduce noise levels to within acceptable limits at the facades of these properties. The mitigation design and the subsequent effects of the proposed mitigation on these and other properties have been assessed in chapter 13.11.

Table 82 **NIR Qualifying Properties**

Road Section	Number of NIR Qualifiers
1	0
2	1
3	4
4	0
5	0
6	0
7	1
8	2
9	4
10	2
11	0
12	1
13	4
14	0
15	1
16	0

13.11 Mitigation of Effects due to Operation

The objectives of the mitigation measures are to ensure that the existing noise environment is not significantly adversely affected by the proposed scheme i.e. that the application of mitigation would offset any potential significant effects associated with noise. Mitigation might also be used to control noise levels associated with the scheme such that noise does not exceed the threshold specified in the NIR.

It can be assumed that all practicable measures have been considered within the context of the scheme to address significant effects. The benefits of any noise mitigations scheme must be balanced against other constraints such as engineering viability, safety and landscaping impacts. The mitigation solution proposed is to use a low noise road surface SMA (Stone Mastic Asphalt). This mitigation would control road noise levels both at facades of properties identified as NIR qualifiers and other areas subject to adverse noise impacts that are predicted to result in significant effects. **Drawings A8-S3-3508, Appendix H, ES Volume II** shows the extent of road sections proposed to be surfaced with the SMA road surfacing.

13.12 Residual Effects due to Operation

This section considers the impact magnitude of the future year (2031) inclusive of the mitigation measures as detailed in chapter 13.11. The mitigation is intended to address areas where significant effects have been assessed and to prevent, where practicable, noise levels exceeding the NIR threshold as a result of the scheme. In some cases mitigation intended to address the latter condition would also result in benefits to reduce noise impacts in the locality.

Again the residual number of NIR qualifying properties adjacent to each road section has been reported.

Section 1

For the mitigated scenario the noise level difference map for the future year (2031) shows that for road Section 1 that noise sensitive dwellings within the scheme assessment area would experience a noise level increase of less than 1dB. This would be rated as a negligible impact and assessed as a ***not significant effect***.

Section 2

Along road Section 2 there are several dwellings and a Sunday School to the west of the new bypass that will experience a reduction in noise level greater than 5dB, which equates to a major beneficial impact. This decrease in noise level would be rated as a major beneficial impact and assessed as a ***significant beneficial effect***. There are two noise sensitive properties near the new bypass that are predicted to have the noise level increases of greater than 5dB. As a result of the mitigation, noise level increase at one dwelling will be reduced from greater than 5dB to between 3-5dB This would be rated as a moderate adverse impact and assessed as ***unlikely to be significant*** to this area given the small number of scattered properties affected. Two of these properties were identified as NIR qualifiers and following the implementation of the mitigation measures these dwellings no longer exceed the threshold limit requiring noise insulation.

Section 3

Adjacent to Section 3 there are three dwellings to the west of this section close to the road. The predicted increase in noise level at these dwellings has been reduced from between 1-3dB to less than 1dB as a result of the mitigation. This would be rated as a minor adverse impact, and would be assessed as ***unlikely to be significant***. Further north, two dwellings to the west which were previously subject to increases of 3-5dB are now subject to increases of 1-3dB. This would be rated as a minor adverse impact, and would be assessed as ***unlikely to be significant.*** The prevailing noise climate at this location has also been reduced such that all NIR qualifying properties no longer exceed the threshold limit requiring noise insulation.

Section 4

Properties adjacent to road Section 4 remain subject to a 1 to 3dB noise level increase. This would be rated as a minor adverse impact and assessed as ***unlikely to be significant***. There are no NIR qualifiers in this section.

Section 5

At properties to the east of road Section 5 noise level decreases greater than 5dB are predicted which would be rated as a major beneficial impact and assessed as ***unlikely to be significant*** as these premises are not residential. To the west of the new junction and road layout there are commercial properties predicted to be subject to a noise level increase greater than 5dB which would be rated as a major adverse impact, and assessed as ***unlikely to be significant***. There are no NIR qualifiers on this section.

Section 6

At Section 6, the inclusion of the mitigation results in the noise increase at seven dwellings on the western edge of Ballynure being reduced from greater than 5dB to 3-5dB. This represents a substantial improvement relative to the unmitigated scenario where noise impacts more than 5dB had been predicted for 13 of the westernmost dwellings at Ballynure. The residual impact would be rated as a moderate adverse impact (rather than major) and although the noise impact would be diminished, it is still assessed as a ***significant effect*** given the number of dwellings affected in this community. Further to the east along the existing A8 alignment, there are a large number of dwellings at Ballynure that border the existing A8 route that are subject to noise level decreases greater than 5dB. These decreases in noise level would be assessed as major beneficial impacts and would be assessed as a ***significant beneficial effect***. The mitigation is not predicted to alter the impact at both the Primary School and the Church of Ireland Church and Parish Hall although the noise levels would be slightly reduced. To the west of the proposed scheme at Millikenstown, significant effects had been identified at a residential community here predicted to be subject to increases in noise level of greater than 5dB. With the inclusion of mitigation to address these impacts, noise levels would be substantially reduced although the properties closest to the scheme here would still be rated as being subject to major adverse impacts. However, part of the community would receive impacts reduced to moderate from major. The overall impact on the community would still be rated as a ***significant adverse effect*** although noise level increases would be minimised. There are no NIR qualifiers in this section.

Section 7

To the east of Section 7 there is one dwelling that is subject to 1 to 3dB increase in noise level. This represents a reduction in noise impact rating to minor adverse impact compared to the unmitigated scheme, and would be assessed as a ***not significant effect.*** The mitigation measures would successfully reduce the noise levels such that there are no longer dwellings subject to noise levels exceeding the threshold limit requiring noise insulation.

Section 8

Adjacent to road Section 8 there are two dwellings that are predicted to be subject to 1 to 3dB increases in noise level, this is a reduction in impact rating to minor adverse impact and would be assessed as a ***unlikely to be significant***. Adjacent to this road section two dwellings were previously identified as NIR qualifiers; with mitigation these properties no longer exceed the threshold limit requiring noise insulation.

Section 9

To the east of Section 9 (Spennin Hill) there is one dwelling subject to an increase in noise level of 3 to 5dB; this is a reduction in impact rating to a moderate adverse impact and assessed as a ***unlikely to be significant***. Two dwellings are also predicted to be subject to a noise increase of 1 to 3 dB which would be rated as minor adverse impact, the significance effect have been reduced to a ***unlikely to be significant.*** As a result of the mitigation, of the four dwellings identified as NIR qualifiers, only one dwelling would remain as an ***NIR qualifier***.

Section 10

To the east of Section 10 there are dwellings that remain subject to noise level increases of between 1 to 3dB and would be rated as minor adverse impact and would be assessed as a ***unlikely to be significant***. There were four dwellings previously identified as NIR qualifiers adjacent to this road section due to the level of the prevailing noise climate. As a result of the mitigation, these dwellings would no longer be subject to noise levels that exceed the threshold limit requiring noise insulation.

Section 11

Along section 11 there are isolated dwellings to the east of this road section that remain subject to a noise level increase of 3 to 5dB. This noise level increase would be rated as a moderate adverse impact and assessed as ***unlikely to be significant*** given the small number affected in this area. To the west there are dwellings that border the existing A8 route that are predicted to experience a noise level decrease of between 1 to 3dB this decrease in noise level would be rated as minor beneficial impact and therefore would be assessed as ***unlikely to be significant***. No properties were identified as NIR qualifiers adjacent to this road section.

Section 12

To the east of Section 12 there are dwellings near to the road that would be subject to a smaller noise level increase of 0 to 1dB as a result of the implementation of mitigation measures. This increase in noise level would be rated as negligible impact and would be assessed as a ***not significant effect***. As a result of implementing mitigation measures it has been predicted that dwellings further to the east and the west of this road section would be subject to a noise level changes of -1 to 1dB. This change in noise level would be rated as a negligible impact and be assessed as a ***not significant effect***. As a result of the mitigation, the dwelling previously identified as an NIR qualifier is no longer predicted to qualify.

Section 13

With mitigation it is predicted that dwellings to the east of Section 13 would be subject to a noise level increase of 0 to 1dB. One dwelling to the west is predicted to be subject to a noise level increase between 1 to 3dB. This noise level increase is rated as negligible and minor impacts respectively, and would be assessed as a ***not significant effect***. As a result of the mitigation, there are no longer any dwellings that border this road section that are subject to noise levels that exceed the threshold limit requiring noise insulation.

Section 14

To the south-east of this section where the new road layout joins the existing road layout there is a dwelling subject to an increase in noise level of 3 to 5dB which remains unchanged. The noise impact at this dwelling would be rated as moderate adverse impact and assessed as ***not a significant effect***. No properties adjacent to this road section were identified as NIR qualifiers.

Section 15

There are dwellings to the east and west of road Section 15 that are subject to noise level decreases of up to 1 to 3dB, these would be rated as a minor beneficial impact and assessed as ***unlikely to be significant***. However, one dwelling closest to this road section was previously identified as an NIR qualifier. As a result of the implementing the mitigation measures, this property would no longer be subject to noise levels that would exceed the threshold limit requiring noise insulation.

Section 16

There are dwellings to the north-east of Section 16 that remain subject to a noise level increase in the range of 1 to 3dB which would be rated as a minor adverse impact and would be assessed as ***unlikely to be significant***. No properties adjacent to this road section were identified as NIR qualifiers.

13.12.1 Residual Potential Noise Nuisance Assessment

The assessment of the predicted noise level changes for the Do Something scenario of the proposed scheme in the future year inclusive of mitigation versus the Do Minimum scenario of the proposed scheme in the baseline year is shown below in Table 83.

It was predicted that a total of 680 dwellings would be subject to noise levels increases of 0.1-0.9dB, 702 dwellings would be subject to a noise level increase of 1-2.9dB, 218 dwellings would experience a noise level increase of 3-4.9dB and 169 dwellings would experience an increase of >5dB.

The predictions also show that a total of 95 dwellings would be subject to a noise level decrease of 0.1-0.9dB, 72 dwellings would be subject to a noise level decrease of 1-2.9dB, 26 dwellings would be subject to a noise level decrease of 3-4.9dB and 24 dwellings subject to a noise level decrease of >5dB.

As an increase in noise nuisance percentage points this amounts to a change of <10% for 286 dwellings, 10%-20% for 631 dwellings, 20%-30% for 585 dwellings, 30%-40% for 256 dwellings and >40% for 77 dwellings across the scheme assessment area. The resulting decrease in noise nuisance of <10% occurs for 205 dwellings across the scheme assessment area.

Comparing the differences between the assessments of the Do Something scenario of the future year, Table 81 and the mitigated Do Something scenario of future year Table 83, the following conclusions can be drawn.

The number of dwellings predicted to experience a noise level increase of >5dB (where impact would be considered major adverse) is reduced by 61 from 230 to 169 dwellings, the number of dwellings predicted to experience a noise level increase of 3-4.9dB (where impact would be considered moderate adverse) is reduced by 72, from 290 to 218 dwellings, and the number of dwellings predicted to experience a noise level increase of 1-2.9dB (where impact would be considered minor adverse) is reduced by 48, from 750 to 702 dwellings.

Due to the impact of reductions in the number of dwellings impacted highest, the number of predicted negligible adverse impacts has increased. The number of dwellings predicted to experience a noise level increase of 0.1-0.9dB has increased by 121, from 559 to 680 dwellings.

In respect to noise level decreases, with the proposed scheme and proposed mitigation measures, the total of dwellings predicted to experience a noise level decrease of 0.1-0.9dB is increased by 23, from 72 to 95 dwellings. The total of dwellings predicted to experience a decrease in noise level of 1-2.9dB is increased by 18 from 54 to 72 dwellings.

Table 83 **Assessment Summary Table Do Something Future year inclusive of proposed mitigation measures**

Change in noise/nuisance level future year (Do Something Mitigated)		**Number of dwellings (façade level noise band LA10,18h dB(A) for Do Minimum scenario in the baseline year)**														
		Total	**< 47.5**	**47.5 - 50.4**	**50.5 - 53.4**	**53.5 - 56.4**	**56.5 - 59.4**	**59.5 - 62.4**	**62.5 - 65.4**	**65.5 - 68.4**	**68.5 - 71.4**	**71.5 - 74.4**	**74.5 - 77.4**	**77.5 - 80.4**	**80.5 - 83.4**	**>= 83.5**
Increase in noise level, LA10,18h dB(A)	**0-0.1**	48	27	3	7	3	1	1	2	2	1	1				
	0.1-0.9	680	395	101	53	42	25	26	11	11	11	5				
	1-2.9	702	373	164	63	35	27	18	18	2	1	1				
	3-4.9	218	89	62	32	13	7	8	5	1	1					
	5+	169	32	43	35	18	12	11	9	3	3	1	2			
Decrease in noise level, LA10,18h dB(A)	**0-0.1**	9	3	1		1	1		1	2						
	0.1-0.9	95	39	11	11	10	10	6	4	3	1					
	1-2.9	72	47	6	5	8	5	1								
	3-4.9	26	26													
	5 +	24	21	1		2										
Increase in nuisance level, percentage points	**< 10**	286	142	44	30	15	10	16	7	8	10	4				
	10 < 20	631	388	100	45	37	24	19	8	6	3	1				
	20 < 30	585	285	135	62	32	28	20	19	2	1	1				
	30 < 40	256	97	79	36	17	8	7	6	1	4	1				
	>= 40	77	4	15	21	10	7	7	7	2	2		2			
Decrease in nuisance level, percentage points	**< 10**	205	136	19	12	21	10	2	3	1	1					
	10 < 20															
	20 < 30															
	30 < 40															
	>= 40															

13.12.2 Noise Insulation Regulations (NIR) Eligibility

In accordance with the NIR requirements, the noise assessment must identify residential properties within 300m of the proposed scheme that are subject to noise levels that meet or exceed NIR criteria (described in chapter 13.2.4).

Table 84 identifies the number of NIR qualifiers per section. Noise levels for these dwellings include the reduced impact due to mitigation design in the future year.

Table 84 **NIR Qualifying Properties**

Road Section	Number of NIR Qualifiers
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	1
10	0
11	0
12	0
13	0
14	0
15	0
16	0

14 Air Quality

14.1 Introduction

This chapter presents an assessment of the effects upon the air environment as a result of upgrading a 14 km stretch of the A8 (Coleman's Corner to Ballyrickard Road) from single carriageway to dual carriageway standard.

This chapter also outlines the current regulatory system relevant for air quality management, the assessment methodology, baseline air quality in the area and the potential changes to air quality associated with the construction and operation of the proposed scheme.

The results of the assessment have been evaluated with reference to the UK Government's Air Quality Strategy objectives and nationally accepted significance criteria. The dominant sources of pollution resulting from the development will be road traffic. The principal pollutants of concern associated with this source which can lead to changes in air quality are nitrogen dioxide (NO_2) and fine particulate matter (PM_{10}). This report focuses on these two pollutants, however, nitrogen deposition is also considered within this assessment in line with current DMRB guidance[87]. Additionally, total emissions resulting from the scheme have been calculated to allow regional impacts to be assessed, again in line with DMRB guidance.

14.2 Legislation and Guidance

14.2.1 Air Quality Standards

Air quality limit values and objectives are quality standards for clean air. They can be used as assessment criteria for determining the significance of any potential changes in local air quality resulting from development proposals.

European Union (EU) air quality policy provides the framework for national policy. The air quality 'framework' Directive on Ambient Air Quality Assessment and Management came into force in September 1996 and is intended as a strategic framework for tackling air quality consistently, through setting Europe wide air quality limit values in a series of daughter directives, superseding and extending existing European legislation. On the 9th of April 2008 the Directive on Ambient Air Quality and Cleaner Air for Europe was introduced under the Thematic Strategy on Air Pollution[88]. The Directive consolidates and simplifies existing air quality legislation and introduced a new standard for particulate matter i.e. $PM_{2.5}$. These directives are transposed into national law through the Air Quality Standards Regulations (Northern Ireland) 2010.

Some pollutants have standards expressed as annual average concentrations due to the chronic way in which they affect health or the natural environment (i.e. effects occur after a prolonged period of exposure to elevated concentrations) and others have standards expressed as 24-hour, one-hour or 15-minute average

[87] The Highways Agency et al. (2007). Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 1 Air Quality, HA207/07.
[88] Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe.

concentrations due to the acute way in which they affect health or the natural environment (i.e. after a relatively short period of exposure). In some cases the short-term concentrations are specified as absolute maximum values, when measured over a set period (e.g. the maximum 1-hour mean concentration out of a full year of hourly values); or the short-term value (e.g. 1-hour mean) can be exceeded a certain number of times in a period: this is the case for NO_2 where 18 of the 1-hour mean concentrations measured in a year can exceed 200 µg/m^3.

Table 85 sets out these EU air quality limit values and the Northern Ireland air quality objectives for the pollutants relevant to this study.

Table 85 **Northern Ireland and EU Air Quality Standards (Human Health)**

Pollutant	Averaging Period	Limit Value/Objective	Date for Compliance	Basis
Nitrogen dioxide (NO_2)	1 hour mean	200 µg/m^3, not to be exceeded more than 18 times a year (99.8th percentile)	31st Dec 2005	NI
			1st Jan 2010	EU
	Annual mean	40 µg/m^3	31st Dec 2005	NI
			1st Jan 2010	EU
Particulate matter (PM_{10})	Daily mean	50 µg/m^3, not to be exceeded more than 35 times a year (90.4th percentile)	31st Dec 2004	NI
			None Specified	EU
	Annual mean	40 µg/m^3	31st Dec 2004	NI
			None Specified	EU
Particulate matter ($PM_{2.5}$)	Annual mean	25 µg/m^3	1st Jan 2015	NI

Performance against these objectives is monitored in locations where people are regularly present and might be exposed to air pollution and it is the responsibility of each local authority to undertake such duties. Each local authority is required to undertake a review and assessment of local air quality (see chapter 14.6.3). The process considers the current air quality situation and the likely future air quality situation, assessing whether the prescribed objectives are likely to be achieved by their target dates.

The DMRB screening tool used in the assessment does not predict concentrations of $PM_{2.5}$. Compliance with this objective is discussed alongside PM_{10}.

Northern Ireland and the EU has furthermore adopted an air quality objective for the protection of vegetation and ecosystems, as outlined in Table 86.

Table 86 **Air Quality Objectives for the Protection of Vegetation and Ecosystems**

Pollutant	Averaging Period	Limit Value/Objective	Date for Compliance	Basis
Nitrogen oxides (NO_x)	Annual Mean	30 µg/m^3	31st Dec 2000	NI
			19th Jul 2001	EU

14.2.2 Dust Nuisance

Dust is the generic term which the British Standard document BS 6069 (Part Two) used to describe particulate matter in the size range 1 – 75 µm (micrometers) in diameter. Dust nuisance is the result of the perception of the soiling of surfaces by excessive rates of dust deposition. Under provisions in the Environmental Protection Act 1990, dust nuisance is defined as a statutory nuisance. There are currently no standards or guidelines for the nuisance of dust in the UK, nor are formal dust deposition standards specified. This reflects the uncertainties in dust monitoring technology, and the highly subjective relationship between deposition events, surface soiling and the perception of such events as a nuisance. However, an informal criterion of 200-250 mg/m²/day (as a 30 day average) is often applied as "custom and practice" in the UK as an indicator of potential nuisance.

14.2.3 National Planning Policy

14.2.3.1 Planning Policy Statement (PPS)13: Transportation and Land Use (2005)

PPS13: Transportation and Land Use[89] provides the Government's transport planning policies, with the objectives of integrating land use planning and transport at a number of levels by: promoting sustainable transport choices; promoting accessibility for all; and reducing the need to travel, especially by private car. A strategic objective of PPS13 is to change the regional travel culture by influencing people towards the use of realistic alternatives to car travel thereby improving air quality. PPS13 advises that innovative measures be developed for the safe and effective management of traffic thereby reducing air pollution and improving quality of life.

14.2.4 National Air Quality Guidance

Air quality guidance advising on the procedures of air quality management and assessment include Local Air Quality Management Policy Guidance[90] and suggestions from non-Government bodies, in particular the Environmental Protection UK (EPUK) guidance[91].

[89] Department of the Environment Northern Ireland (2005) Planning Policy Statement 13: Transportation and Land Use
[90] DEFRA (2009). Part of the Environment Act 1995: Local Air Quality Management: Policy Guidance (PG09), Department for Environment Food and Rural Affairs, February 2009
[91] EPUK (2010). Development Control: Planning for Air Quality.

14.2.4.1 Local Air Quality Management Policy Guidance Northern Ireland LAQM.PGNI(09)

Policy guidance note LAQM.PGNI(09) provides additional guidance on the links between transport and air quality. The guidance describes how road transport contributes to local air pollution and how transport measures may bring improvements in air quality.

LAQM.PGNI(09) also provides guidance on the links between air quality and the land use planning system. It summarises the main ways in which the land use planning system can help deliver air quality objectives. The objectives relevant to this assessment are detailed in Table 85.

14.2.4.2 Environmental Protection UK (EPUK) Guidance – Development Control: Planning for Air Quality

The 2010 EPUK guidance note 'Development Control: Planning for Air Quality'[91] responds to the need for closer integration between air quality and development control. It provides a framework for air quality considerations within local development control processes, promoting a consistent approach to the treatment of air quality issues within development control decisions. The guidance has been widely used by local authorities, air quality consultants and developers.

The guidance includes a method for assessing the significance of the impacts of development proposals in terms of air quality and how to make recommendations relevant to the development control process in light of the assessment, detailed further in chapter 14.4.5.1. The need for early and effective dialogue between the developer and local authority is identified to allow air quality concerns to be addressed as early in the development control process as possible. The guidance also provides some clarification as to when air quality constitutes a material consideration in the planning decisions process.

14.2.5 Regional Planning Policy and Air Quality Guidance

14.2.5.1 Regional Development Strategy (RDS) for Northern Ireland: Shaping Our Future 2025

The RDS sets out the strategic development framework which is to shape development of Northern Ireland to 2025. Of relevance to road schemes is "*SPG-ENV 6: To create healthier living environments and to support healthy lifestyles*". This policy reinforces the importance of maintaining national air quality standards and local air quality management. It is stated that reduction of industrial emissions and traffic are key to improving air quality.

14.2.5.2 Greater London Authority (GLA) Best Practice Guidance

The GLA Best Practice Guidance[92] provides guidance for the control of dust and emission from construction and demolition activities. This document is a London focussed document to provide consistent best practice for demolition and construction sites across London. However, the principles of best practice can be applied to other areas outside of London. The guide builds on existing guidance and takes into account the latest best practice and new techniques.

14.3 Scoping and Consultation

14.3.1 Scoping

An ES Scoping Report was issued in March 2010 to key statutory and non-statutory bodies outlining the approach, methodology, baseline conditions and expected effects of the scheme.

It was circulated to all stakeholders, offering them an opportunity to address the proposed methodologies for the EIA or to address issues that have not been adequately covered. A list of consultees is included in chapter 7.3.

14.3.2 Consultation

Environmental Health Officers (EHOs) at both Newtownabbey Borough Council and Larne Borough Council were consulted through the scoping process and a number of ELG meetings (see chapter 7.2.2 for details). No issues with regards to the methodology used in this assessment was received or raised as a concern.

14.4 Assessment Methodology

14.4.1 Introduction

The overall approach to the air quality study includes:

- A review of the existing or baseline air quality in the area;
- An assessment of the potential impact of the construction of the proposed scheme on air quality with regard to human receptors;
- An assessment of the potential changes in air quality at representative human receptors arising from the operation of the A8 Dualling by comparison of the situation with and without the proposed dualling in future years;
- An assessment of the change in NO_2, PM_{10}, $PM_{2.5}$ and carbon dioxide (CO_2) emissions arising from the proposed scheme;
- Formulation of mitigation measures, where appropriate, to ensure any adverse effects on air quality are minimised or avoided; and
- A description of the residual effects following mitigation.

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[92] Best Practice Guidance: The control of dust and emissions from construction and demolition - Produced in partnership by the Greater London Authority and London Councils, November 2006.

14.4.2 Methodology for Establishing Baseline Conditions

Existing or baseline ambient air quality refers to the concentration of relevant substances that are already present in the environment – these are present from various sources, such as industrial processes, commercial and domestic activities, agriculture, traffic and natural sources. The following data sources have been employed in this assessment:

- Northern Ireland air quality network data[93];
- Northern Ireland Environment Agency website[94];
- The UK Air Quality Archive[95];
- The Defra Local Air Quality Management website[96];
- Newtownabbey Borough Council website[97];
- Larne Borough Council website[98];
- Larne Review and Assessment of Air Quality documents; and
- Newtownabbey Review and Assessment of Air Quality documents.

14.4.3 Methodology for Assessment of Effects due to Construction

14.4.3.1 Construction Vehicle Emissions

DMRB[87] requires a screening assessment where traffic is considered significant, fulfilling the following criteria for changes in traffic flow:

- Daily traffic flows will change by 1,000 AADT (annual average daily traffic) or more; or
- Heavy Duty Vehicle (HDV) flows will change by 200 AADT or more.

The scheme is predicted to generate significant construction traffic along the 'southern section' of dualling between the A8/B95 (Colman's Corner) junction and the A8/A57 junction, where an increase in AADT of approximately 500 and an increase in HDV flows of approximately 300 is expected. The increase in HDVs triggers the need for a DMRB screening assessment. All other roads experience increases in traffic from construction at levels below the DMRB thresholds and therefore have not been assessed.

The assessment of construction traffic follows a similar approach to that set out in the assessment of operational traffic (chapter 14.4.4.1) with a more limited number of receptors and with the assessment for the construction year 2014. Details of the assessment specific to construction are given below. For further details of the traffic data used see chapter 14.4.4.1.

[93] www.airqualityni.co.uk/
[94] www.ni-environment.gov.uk
[95] www.airquality.co.uk
[96] www.defra.gov.uk/environment/quality/air/airquality/local/support/
[97] www.newtownabbey.gov.uk/
[98] www.larne.gov.uk/

Assessment Scenarios

The A8 Dualling scheme is identified within the Investment Delivery Plan for Roads (IDP) to be delivered between 2013/14 to 2017/18. An assessment year of 2014 was chosen to give worst case (higher) background concentrations and vehicle emission factors (since traffic related emissions are forecast to decrease over time). The assessment scenarios are summarised as follows:

- Baseline (2008) scenario;
- Do Minimum (2014) scenario without construction traffic; and
- Do Something (2014) scenario with construction traffic.

A comparison of the Do Minimum and Do Something scenarios allows the impact of the proposed scheme to be determined.

Traffic Data and Assumptions

Baseline traffic data for the assessment of construction traffic are as described in chapter 14.4.4.1 and are the same as were used for the assessment of operational traffic. Indicative construction traffic flows were developed in conjunction with the contractor, and were added to the flows on the existing A8 to give 2014 Do Something scenario flows. These flows are predominantly haulage vehicles transporting material (approximately 300 AADT) to and from site as well as worker transport (approximately 200 AADT).

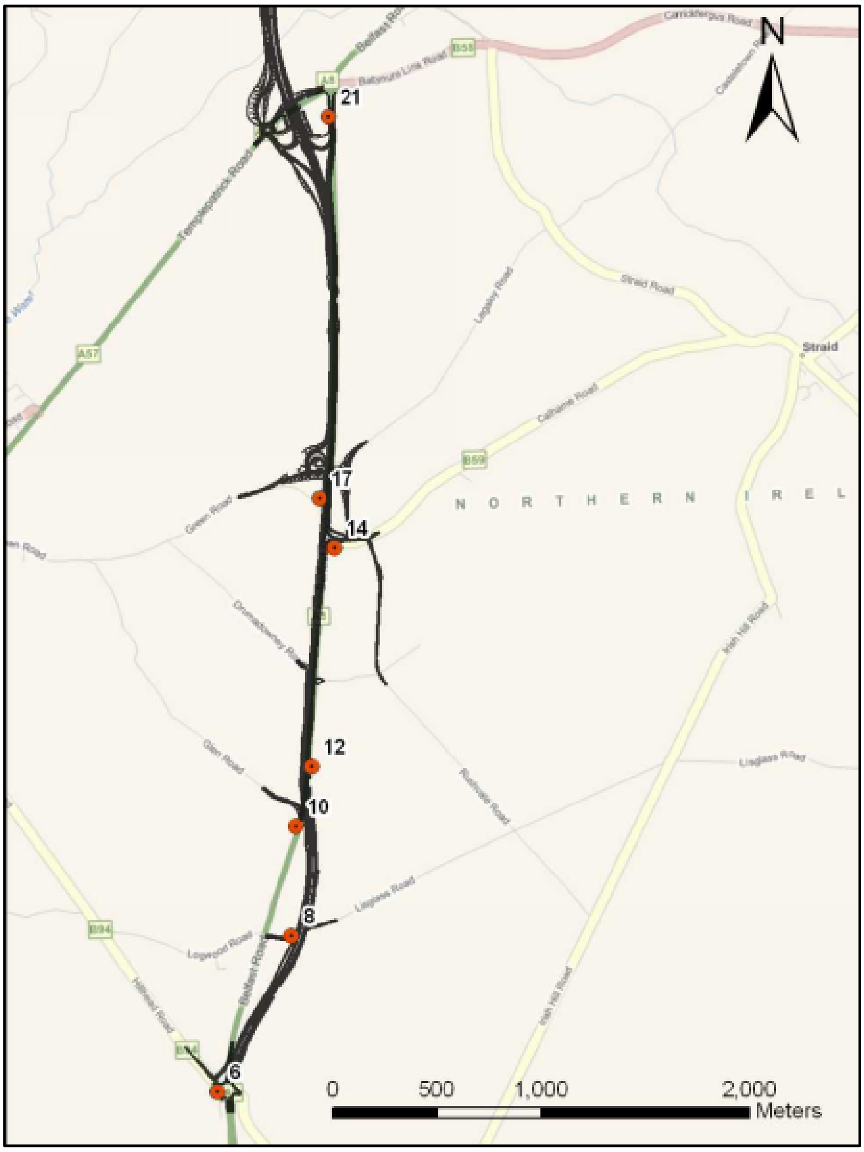
Receptors

Pollutant concentrations have been forecast at selected properties (receptors) along existing roads likely to be most affected by construction traffic, i.e. the 'Southern Section' of dualling between the A8/B95 junction and the A8/A57 junction. These receptors are at the same locations as those used in the operational assessment (additional receptors have been included at other locations for the operational assessment). Receptor co-ordinates are given in Table 87 and their locations are illustrated in Figure 9 along with the proposed dualled A8 layout.

Table 87 **Location of Construction Traffic Assessment Receptors (co-ordinates)**

Receptor	Northern Ireland OS Co-ordinates	
	X	Y
6	330847	388271
8	331204	389019
10	331223	389543
12	331302	389832
14	331410	390879
17	331339	391117
21	331379	392948

Figure 9 **Location of Construction Traffic Assessment Receptors**



Background Pollutant Concentrations

Within the DMRB model, background pollutant concentrations are added to the modelled roadside concentrations in order to take into account emissions from sources other than vehicles. Local background data for NO_x, NO_2 and PM_{10} were obtained from the Defra website[96] for the relevant grid square in which each modelled receptors lies. The background at the selected receptors for 2008 and 2014 are shown in Table 88. For each receptor, background concentrations apportioned to Trunk A Roads or Primary A Roads were removed where they were explicitly modelled in DMRB to avoid double counting the effect of these emissions in the assessment.

Table 88 **Background Concentrations at Construction Traffic Assessment Receptors ($\mu g/m^3$)**

Receptor	2008			2014		
	NO_X	NO_2	PM_{10}	NO_X	NO_2	PM_{10}
6	9.4	6.8	11.5	6.4	4.8	10.7
8	9.0	6.6	11.4	6.3	4.7	10.6
10	9.0	6.6	11.4	6.3	4.7	10.6
12	9.0	6.6	11.4	6.3	4.7	10.6
14	9.1	6.7	11.3	6.2	4.6	10.5
17	8.9	6.5	11.3	6.0	4.5	10.5
21	9.1	6.6	11.5	6.1	4.5	10.6

NO_X to NO_2 Conversion

Details of the method used to convert NO_X concentrations, predicted by DMRB, to NO_2 concentrations for comparisons with the annual mean air quality objective can be found in chapter 14.4.4.1.

14.4.3.2 Dust Emissions

Construction dust impacts have been assessed following a risk-related approach adapted from the GLA Best Practice Guidance[92] and appropriate mitigation measures have been provided. Whilst the guidance has been produced by the GLA and London Councils, it can equally be applied to construction sites outside London.

The assessment of air quality effects during construction involved a review of the proposed demolition and construction works to determine the potential for dust nuisance and hence, additional mitigation required. This included the following steps:

- Identify and total the dust sensitive receptors within 25m, 50m, 100m and 200m of the construction site boundary to identify the scale of effect (high, medium or low) (see Table 89); and
- Determine the duration of dust raising activities on each site and the potential for dust to have a nuisance impact and hence, whether the site is low, medium or high risk, based on the threshold in Table 90.

Table 89 **Thresholds for Potential Dust Nuisance**

Distance from Site Boundary	No. of Sensitive Properties		
	0 - 10	11 - 100	101 - 1000
0 – 25m	High	High	High
25 – 50m	Medium	High	High
50 – 100m	Low	Medium	Medium
100 – 200m	Negligible	Low	Low

Distance from Site Boundary	No. of Sensitive Properties
High – potential for emissions and dust to have a significant impact on sensitive receptors Medium – potential for emissions and dust to have an intermittent or likely impact on sensitive receptors Low – potential for emissions and dust to have an infrequent impact on sensitive receptors	

Adjustments are made to these ratings to account for the scale and duration of dust raising activities as shown in Table 90.

Table 90 **Adjustments to Dust Nuisance Potential**

Duration of Dust Raising Activities	Scale of Dust Raising Potential		
	High	**Medium**	**Low**
0 – 3 months	No adjustment	No adjustment	No adjustment
3 – 6 months	Increase by one step	No adjustment	No adjustment
6 – 12 months	Increase by two steps	Increase by one step	No adjustment
> 12 months	Increase by two steps	Increase by two steps	Increase by one step
One step – from 'negligible' to 'low', 'low' to 'medium', 'medium' to 'high' Two steps – from 'negligible' to 'medium', 'low' to 'high' or 'medium' to 'high'			

Different construction activities can be categorised into different dust raising potential classes (high, medium, low). Activities, such as earthmoving, excavation, grading, stockpiling and crushing have a high dust raising potential. Medium risk activities include concrete batching, loading and unloading of vehicles, demolition, grinding, grit blasting and transport of materials. Low risk activities with regard to dust raising potential include landfilling, cutting, burning of material and movement of dirty vehicles.

The extent of mitigation required, as outlined in the GLA Best Practice Guidance, has then been defined based on whether the site is identified as low, medium or high risk. This is further detailed in chapter 14.8.

14.4.4 Methodology for Assessment of Effects due to Operation

14.4.4.1 Local Air Quality Effects

Air quality impacts have been assessed in accordance with the DMRB[87]. Traffic related emissions have been assessed using the DMRB screening tool to calculate pollutant concentrations at specified receptors near to the A8 and roads affected by the scheme. The assessment focuses on the two key pollutants related to traffic emissions; NO_2 and PM_{10}.

Assessment Scenarios

The assessment scenarios are summarised as follows:

- Baseline (2008) scenario;
- Do Minimum (2016) scenario without the dualled A8;

- Do Something (2016) scenario with the dualled A8;
- Do Minimum (2031) scenario without the dualled A8; and
- Do Something (2031) scenario with the dualled A8.

A comparison of the Do Minimum and Do Something scenarios in each of the assessment years (2016 and 2031) allows the impact of the proposed scheme to be determined.

Traffic Data

Baseline and forecast traffic data[99] for the local road network consisted of AADT flows, percentage of HDV and average vehicles speeds on a network of roads which would be affected by the A8 Dualling scheme for each of the scenarios described above.

The network includes the A8 itself, roads radiating away from the A8 and roads parallel to the A8. The extent of traffic data provided is illustrated in Figure 10. The road network shown below is not geographically accurate but is indicative of road locations. Separate high quality mapping data were used to measure the distance between receptors and assessed road centrelines required in the DMRB model.

[99] Traffic data provided by Ove Arup and Partners transport consultants.

Figure 10 **Extent of Road Data**

© 2010 Microsoft

Receptors

Pollutant concentrations have been forecast at selected properties (receptors) where the effects of the dualling scheme on air quality are potentially the greatest. This includes selected residential properties close to the existing and proposed route of the A8, and roads which intersect and run parallel to the A8. Receptors were chosen mostly around junctions where exposure to pollutants is likely to be greatest and is likely to be most affected by the development. Details of the receptors are given in Table 91 and their locations are illustrated in Figure 11 along with the proposed dualled A8 layout.

Receptor 20 is a property located at 10 Templepatrick Road and would be taken by agreement or by vesting in the Do Something scenarios. Results in the Do

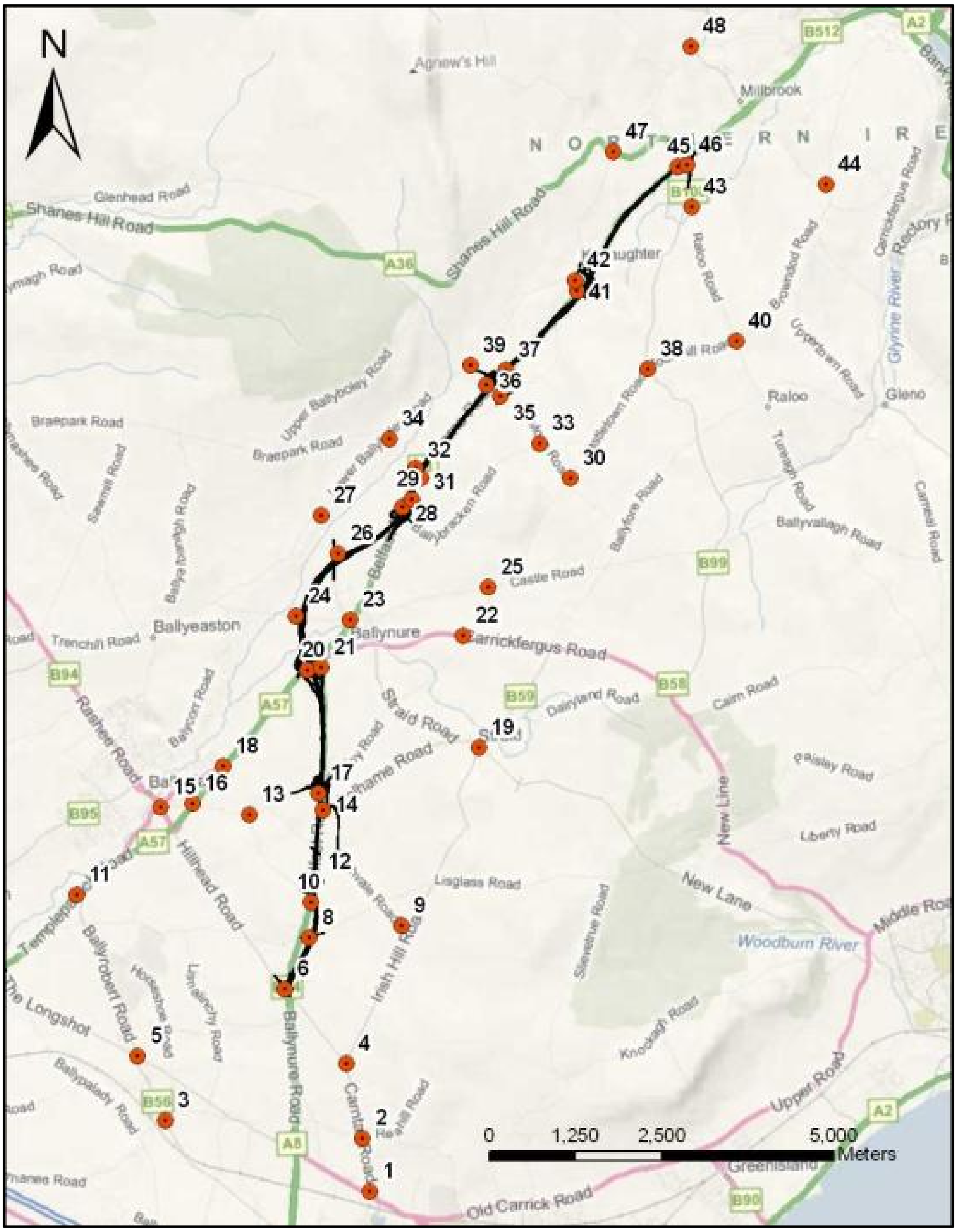
Something scenarios and significance of impact are not calculated for this receptor.

Table 91 **Grid References of Receptors**

Receptor	Northern Ireland OS Co-ordinates	
	X	Y
1	332149	385333
2	331979	386114
3	329109	386364
4	331741	387195
5	328715	387302
6	330847	388271
7	326688	388542
8	331204	389019
9	332540	389202
10	331223	389543
11	327827	389644
12	331302	389832
13	330333	390810
14	331410	390879
15	329044	390925
16	329514	390978
17	331339	391117
18	329958	391515
19	333664	391784
20*	331172	392915
21	331379	392948
22	333442	393412
23	331803	393641
24	331007	393701
25	333804	394120
26	331620	394607
27	331384	395158
28	332561	395286
29	332692	395387
30	334990	395695
31	332829	395699
32	332748	395842
33	334550	396200
34	332373	396267
35	333984	396898

Receptor	Northern Ireland OS Co-ordinates	
	X	Y
36	333777	397060
37	334065	397265
38	336118	397287
39	333544	397337
40	337403	397689
41	335094	398426
42	335067	398568
43	336753	399638
44	338708	399964
45	336557	400217
46	336689	400252
47	335617	400435
48	336744	401966
* Receptor 20 will be acquired by agreement/vesting to make way for the development and so no predictions "with-scheme" are made		

Figure 11 **Location of Receptors**



Background Pollutant Concentrations

The background concentrations near the dualling scheme for 2008, 2016 and 2031 are shown in Figure 12, Figure 13 and Figure 14. It can be seen in all cases that background air quality is generally predicted to improve with time as vehicles produce less pollution, counteracting any predicted increase in baseline traffic.

Figure 12 **Background NO_X Concentrations in the Vicinity of the Proposed A8 Dualling**

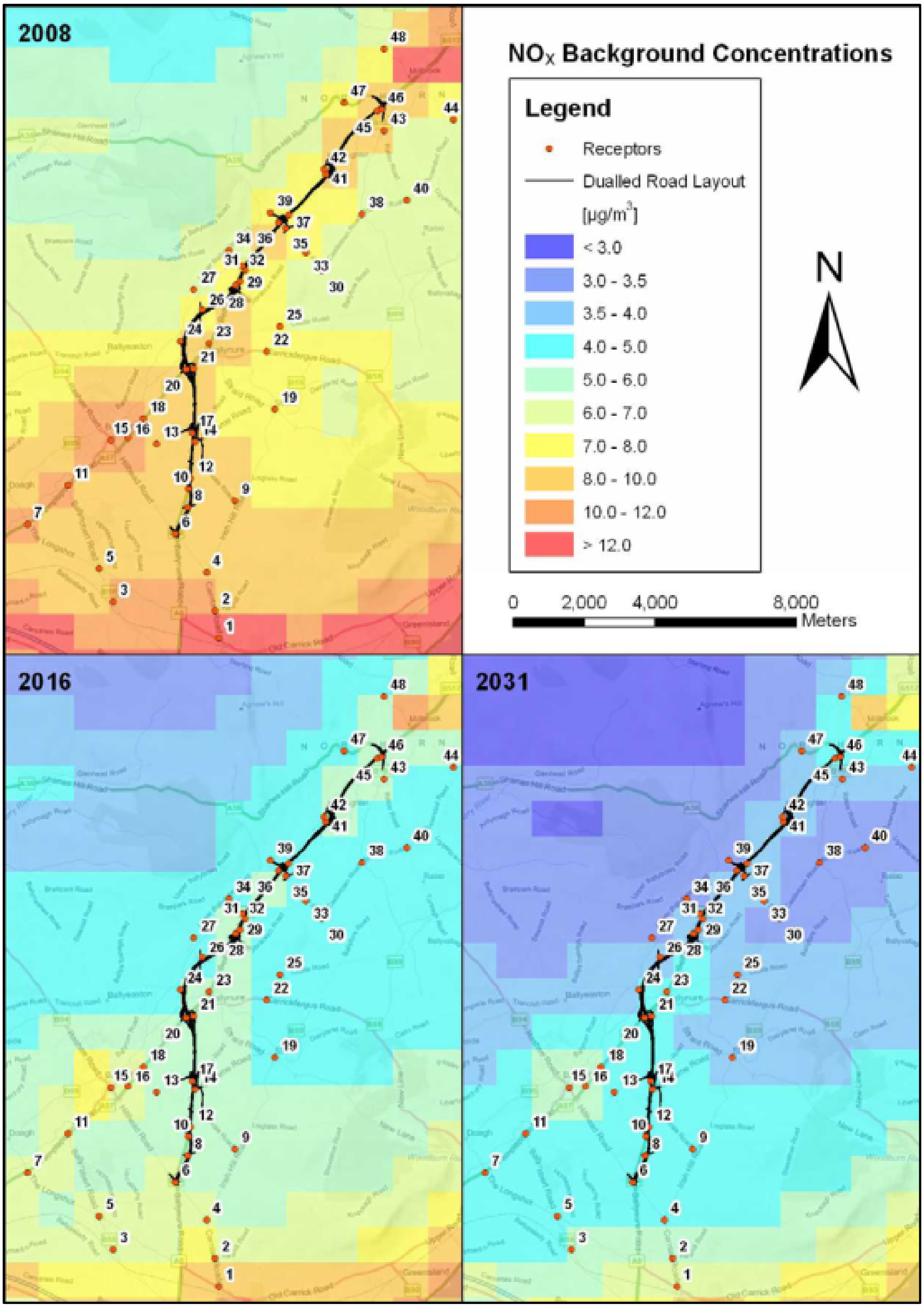


Figure 13 **Background NO_2 Concentrations in the Vicinity of the Proposed A8 Dualling**

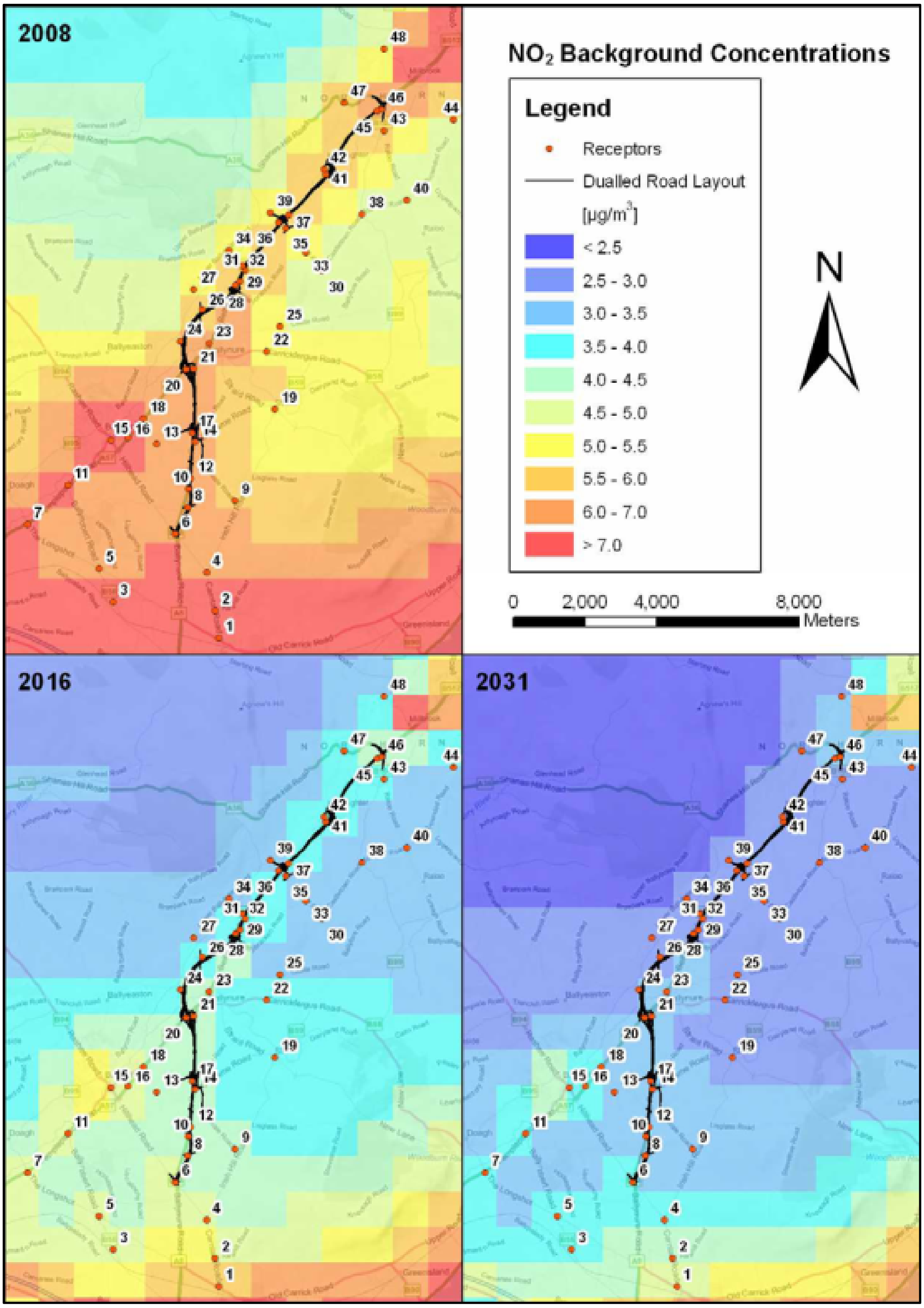
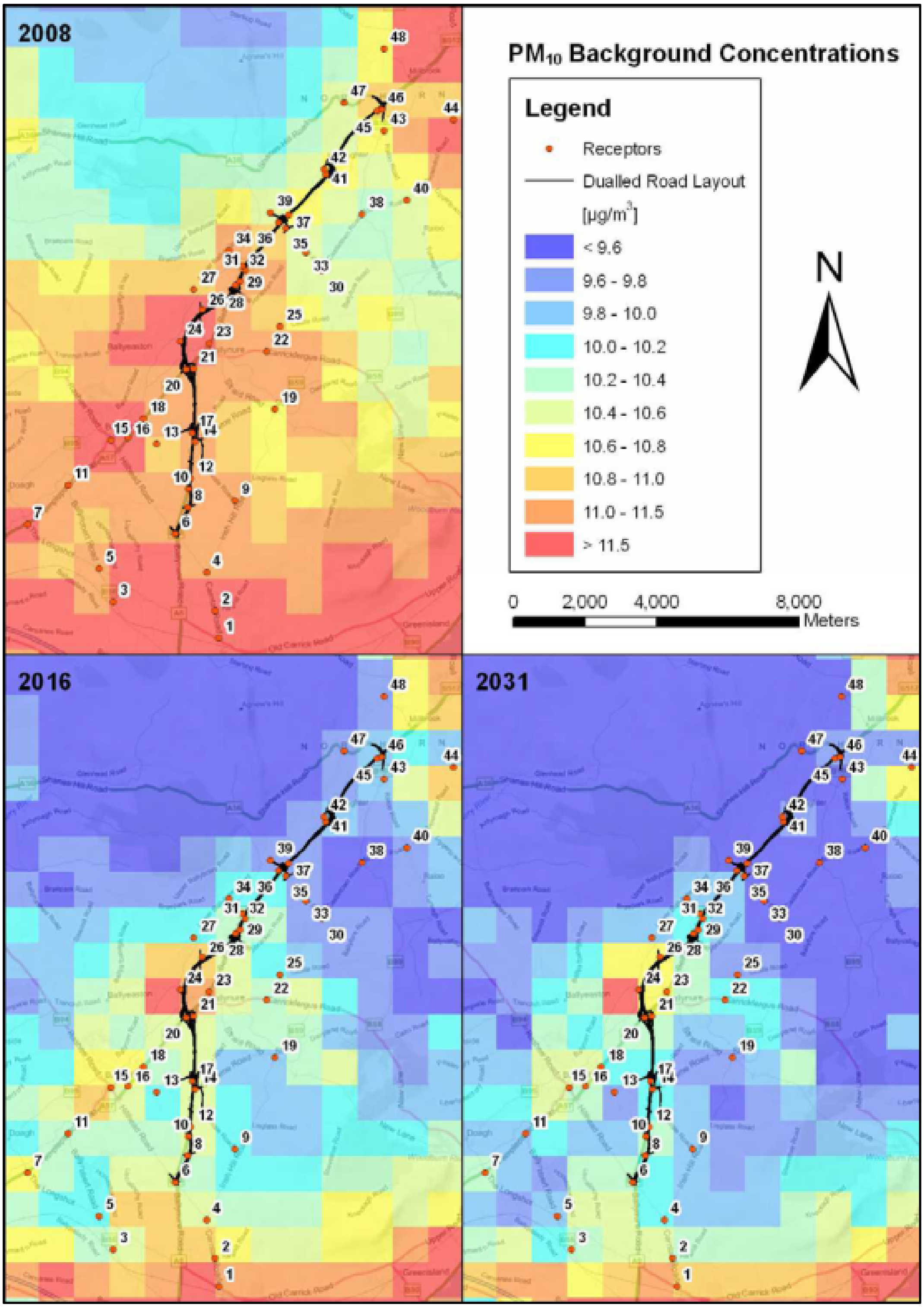


Figure 14 **Background PM_{10} Concentrations in the Vicinity of the Proposed A8 Dualling**



NO_X to NO_2 Conversion

The model predicts NO_X concentrations which comprise principally nitric oxide (NO) and a small percentage of NO_2. The emitted NO reacts with oxidants in the air (mainly ozone) to form more NO_2. Since only NO_2 is associated with effects on human health, the air quality standards for the protection of human health are based on NO_2 and not total NO_X or NO. A suitable NO_X:NO_2 conversion needs to be applied to the modelled NO_X concentrations.

The NO_X to NO_2 conversion calculator available from the Defra website[96] was used to calculate NO_2 concentrations from the modelled roadside NO_X contributions and background NO_2 and NO_X levels.

14.4.4.2 NO_X and Nitrogen Deposition Effects

DMRB states that any nature conservation sites ('designated sites') and their characteristics should be identified as part of the air quality assessment. The designated sites that should be considered for an assessment are those for which the designated features are sensitive to air pollutants, either directly or indirectly, and which could be adversely affected by the air pollution.

Only two nationally significant designated sites lie within 200 m of the road network of traffic: Ballypalady Areas of Special Scientific Interest (ASSI) 190 m from the A57 Templepatrick Road (approximately 5km from the proposed scheme; and Antrim Coast and Glens Area of Outstanding Natural Beauty (AONB) directly adjacent to Deerpark Road. Both these roads are predicted to experience a change in AADT of less than 100 in the assessment years 2016 and 2031. The DMRB requires an assessment of roads that experience a change of greater 1,000 AADT so an investigation of the impact of the scheme on these conservation sites is not required.

14.4.4.3 Regional Air Quality Effects

A quantitative assessment of the total pollutant emissions of NO_X, PM_{10}, $PM_{2.5}$ and CO_2 over the scheme area has been undertaken using the regional calculation methodology set out within the DMRB screening method. This has been used to calculate the total pollutant emissions (in tonnes per year) over the area covered by the transport model in the Do Minimum (without A8 Dualling) and Do Something (with A8 Dualling) scenarios for the proposed year of opening (2016) and future assessment year (2031).

To assess only roads which are affected by the scheme, roads were screened using criteria set out in DMRB[87] for regional assessments. Roads in the network which changed with the scheme by any of the following in either 2016 or 2031 were included in the assessment:

- A change of more than 10% AADT; or
- A change of more than 10% to the number of heavy duty vehicles; or
- A change in daily average speed of more than 20 km/hr.

These screened-in roads are shown in Figure 15.

Figure 15 **Regional Air Quality Screened-in Roads**

14.4.5 Significance Criteria

14.4.5.1 Construction Vehicle Emissions Criteria

The EPUK Guidance[91] provides an approach to determining the significance of impacts resulting from a proposed development on local air quality both for individual receptors and for a whole scheme. The guidance provides a basis on how to describe the significance of the impacts predicted from an air quality modelling study (such as DMRB), specifically for the pollutants NO_2 and PM_{10}. The guidance incorporates the latest position of the IAQM on impact significance. The descriptors of change are determined as follows:

i. Predict the absolute change (in µg/m^3) in the annual mean concentrations of NO_2 and PM_{10}, and the number of days in which the mean PM_{10} concentration is greater than 50 µg/m^3;

ii. Determine the descriptor of change resulting from the development using the criteria in Table 92;

iii. Use the descriptor to assess the impact significance for each of the pollutants in relation to changes in the absolute concentration forecast from the modelling with the proposed development in place (Table 93 and Table 94). The descriptor depends on the magnitude of the predicted concentrations in relation to the relevant objective/limit value.

Table 92 **Definition of Impact Magnitude for Changes in Pollutant Concentrations**

Magnitude of Change	**Change in NO_2 and PM_{10} Annual Mean Concentrations (µg/m^3)**	**Change in Number of Day with PM_{10} Concentrations Greater than 50 µg/m^3**
Large	> 4.0	Increase/decrease > 4 days
Medium	2.0 – 4.0	Increase/decrease 2-4 days
Small	0.4 – 2.0	Increase/decrease 1-2 days
Imperceptible	< 0.4	Increase/decrease <1 day

Table 93 **Descriptors for Impact Significance for NO_2 and PM_{10} Annual Mean Concentrations**

Absolute Concentration in Relation to Objective/Limit Value	**Change in Concentration**		
	Small	**Medium**	**Large**
Increase with Scheme			
Above Objective/Limit Value with Scheme (40 µg/m^3)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value with Scheme (36-40 µg/m^3)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value with Scheme (30-36 µg/m^3)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value with Scheme (<30 µg/m^3)	Negligible	Negligible	Slight Adverse
Decrease with Scheme			
Above Objective/Limit Value without Scheme (40 µg/m^3)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value without Scheme (36-40 µg/m^3)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value without Scheme (30-36 µg/m^3)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value without Scheme (<30 µg/m^3)	Negligible	Negligible	Slight Beneficial

Table 94 **Descriptors of Impact Significance for Days with PM_{10} Concentrations Greater than 50 µg/m^3**

Absolute Concentration in Relation to Objective/Limit	**Change in Concentration**		
	Small	**Medium**	**Large**
Increase with Scheme			
Above Objective/Limit Value with Scheme (>35 days)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value with Scheme (32-35 days)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value with Scheme (26-32 days)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value with Scheme (< 26 days)	Negligible	Negligible	Slight Adverse
Decrease with Scheme			
Above Objective/Limit Value without Scheme (>35 days)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value without Scheme (32-35 days)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value without Scheme (26-32 days)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value without Scheme (< 26 days)	Negligible	Negligible	Slight Beneficial

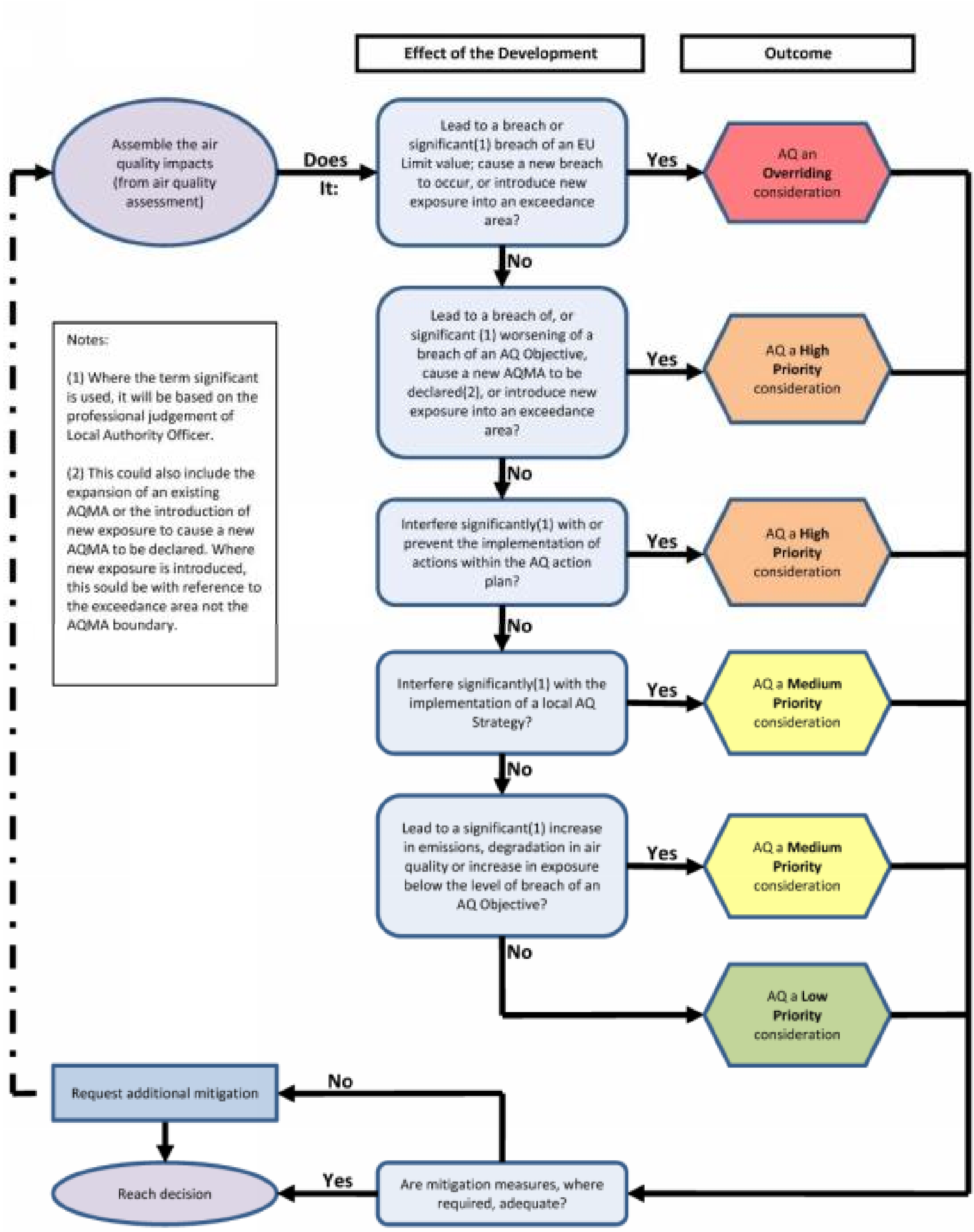
To determine the overall significance, the EPUK guidance provides a set of factors, within Table 95, that air quality should be afforded in the planning process, stating that these factors allowing professional judgement to be made should be given weighting equal to the flowchart determination method described below. These factors should be considered, before a suitably qualified professional can determine, with sufficient justification, whether the overall impact of a potential development should be termed ‘insignificant’, ‘minor’, ‘moderate’ or ‘major’. This method is less prescriptive than the flow-chart determination method, allowing professional judgement to be made on a case by case basis. Professional judgement is important as rigorous application of a numerical/prescriptive approach can and has resulted in anomalous assessment conclusions.

The EPUK flowchart approach assumes air quality impacts have been assessed and quantified. The significance of the impacts is then assessed using a flow chart (Figure 16) through a series of questions with closed (yes and no) answers. Each question is addressed in descending order until the arrow points to one of the outcomes in the right hand column. This gives the relative priority which air quality considerations should be afforded with respect to the development proposal.

Table 95 **EPUK Factors to Judge Significance**

- Number of people affected by slight, moderate or major air quality impacts and a judgement on the overall balance;
- Where new exposure is being introduced into an existing area of poor air quality, then the number of people exposed to levels above the objective or limit value will be relevant;
- The magnitudes of the changes and the descriptions of the impacts at the receptors i.e. and Table 93 and Table 94 findings;
- Whether or not an exceedence of an objective or limit value is predicted to arise in the study area where none existed before or an exceedence area is substantially increased;
- Whether or not the study area exceeds an objective or limit value and this exceedence is removed or the exceedence area is reduced;
- Uncertainty, including the extent to which worst-case assumptions have been made; and
- The extent to which an objective or limit value is exceeded e.g. an annual mean NO_2 of 41 $\mu g/m^3$ should attract less significance than an annual mean of 51 $\mu g/m^3$.

Figure 16 **EPUK Steps to Assess the Significance of Impacts of a Development Proposal**



14.4.5.2 Dust Assessment Significance Criteria

As there is no guidance specific to Northern Ireland, construction dust impacts have been assessed following a risk-related approach adapted from the GLA Best Practice Guidance[92].

The significance criteria of potential construction impacts 'high', 'medium' and 'low', as described in chapter 14.4.3 and Table 89 and Table 90 have been used in this assessment.

The level of significance identified determines the level of mitigation required and measures to be incorporated in the CoCP.

14.4.5.3 Operational Assessment Significance Criteria

The construction vehicle assessment significance criteria are the same as those used in the construction assessment (see chapter 14.4.5.1).

14.5 Limitations and Assumptions

Limitations and assumptions are numerous and are discussed throughout the methodology (chapter 14.4) where applicable.

14.6 Baseline

This section describes the existing air quality baseline conditions within and, where appropriate, near to the scheme assessment area. Existing or baseline ambient air quality refers to the concentration of relevant substances that are already present in the atmosphere – these are present from various sources, such as industrial processes, commercial and domestic activities, agriculture, traffic and natural sources.

14.6.1 Air Pollution Sources – Industrial Processes

Industrial air pollution sources are regulated through a system of operating permits or authorisations, requiring stringent emission limits to be met and ensuring that any releases are minimised or rendered harmless. Regulated (or prescribed) industrial processes are classified as Part A, Part B or Part C processes. Part A, B and C processes are regulated under The Pollution Prevention and Control Regulations (Northern Ireland) 2003.

There are currently three Part A processes and six Part B processes licensed or pending licences in Newtownabbey. All of the Part A and Part B processes are located around Mallusk, approximately 3.5 km to the south of the scheme, with a range of processes listed including concrete batching and coating processes. Emissions to air from these processes are included in background concentration data used in this assessment. Part C processes are reviewed by Newtownabbey Borough Council (NBC) for Local Air Quality Management and are not considered likely to significantly affect ambient air quality in the vicinity of the scheme.

There are currently five Part A process and Part B processes licensed in Larne. The closest is the FP McCann Loughside Quarry located at 146 Belfast Road, just off the A8 to the east of the scheme. Emissions to air from these processes are included in background concentration data used in this assessment. Part C processes are reviewed by Larne Borough Council (LBC) for Local Air Quality Management and are not considered likely to significantly affect ambient air quality in the vicinity of the scheme.

Because the emissions from the industrial processes are already included in the background data it is not necessary to model the impact of these sources. It is assumed therefore, in the assessment that these processes will still be operating in 2016 and 2031 and hence air quality may be better than assumed in this assessment if the processes have ceased operation or possibly worse if additional processes have begun operating.

14.6.2 Air Pollution Sources – Road Sources

In recent decades, transport atmospheric emissions, on a national basis, have grown to match or exceed other sources in respect of many pollutants, particularly in urban areas.

The principal pollutants (produced as a result of traffic emissions) that have been identified as being of most concern by the UK Government's National Air Quality Strategy (NAQS) and in the DMRB guidance[87] are:

- Carbon monoxide (CO);
- Nitrogen dioxide (NO_2);
- Fine particulate matter (PM_{10}); and
- Volatile Organic Compounds, especially benzene and 1,3-butadiene.

Vehicle emissions are the dominant source of air pollutants in the vicinity of the proposed site. This assessment focuses on the two primary air pollutants; NO_2 and PM_{10}, emitted by vehicular traffic.

The dominant roads in the scheme assessment area are the A8 and A57. The A36 connects to the northern part of the assessed network. Other than these roads, only minor rural roads are within the vicinity of the A8 Dualling scheme.

14.6.3 Local Authority Review and Assessment of Air Quality

Under the Air Quality Management Order Environment (NI) Order 2002, local authorities in Northern Ireland are required to carry out a Review and Assessment of their local air quality. The Review and Assessment process in Northern Ireland is given a statutory basis by the Local Air Quality Management Bill.

A Review and Assessment has been undertaken by both NBC and LBC.

The scheme assessment area does not lie within an Air Quality Management Area (AQMA)[100], although AQMAs have been designated for NO_2 within the Newtownabbey local authority areas. The closest AQMA (Newtownabbey AQMA No 2 – Ballyclare on Main Street) to the proposed scheme is located more than 1.5 km west of the A8 scheme but just north west of Mill Road included in

[100] An Air Quality Management Area (AQMA) is an area where the air quality objectives are not likely to be achieved. AQMAs essentially represent areas which have an air pollution problem.

the assessed traffic network. Traffic data is not available for Main Street and so the impact of the scheme on receptors in the AQMA cannot be assessed, but is likely to be minimal. Receptor 15 (3 Hillhead Road) directly adjacent to the AQMA has been included in the operational assessment.

As of the Larne Borough Council 2010 Progress Report, no AQMAs have been declared or are being considered within LBC.

14.6.4 Ecological Sites Sensitive to Air Quality

There are no designated sites of national importance or sites sensitive to air quality (see chapter 14.4.4.2) within the immediate vicinity of the proposed location of road works associated with dualling the A8. The closest designated sites are: the Larne Lough ASSI, SPA and Ramsar site (multiple designations) situated approximately 4 km east of the scheme, and the Ballypalady ASSI situated approximately 5 km south west of the scheme.

The locally important ecological site Clements Wood Nature Conservation Site, managed by the Woodland Trust, is situated along the A8 north of Ballynure.

14.6.5 Local Air Quality Monitoring

NBC's 2009 Updating and Screening Assessment report contains results from NO_2 monitoring at three continuous monitors in the Borough as well as diffusion tube data from an additional 22 sites. One continuous monitor is located on Main Street in Ballyclare and this is co-located with two diffusion tubes just outside the assessed road network. The remaining monitors are concentrated to the south of the Borough mainly around the M2 and urban areas. Details of the Ballyclare sites with monitoring results are presented in Table 96. Monitoring in LBC does not lie within the A8 scheme area.

Table 96 **Ballyclare AQMA Annual Mean NO_2 Monitoring Results**

Site ID	Location	Type	Grid Reference	Annual Mean Concentrations (µg/m^3)	
				2007	2008
Continuous Monitors					
-	Main Street	Roadside	328851,391134	35.9	37.0
Diffusion Tubes					
C1	Main Street	Roadside	328854,391134	36.2	30.0
C59	Main Street	Roadside	328854,391134	32.7	28.0

Local air quality monitoring has previously been conducted at one location within the vicinity of the proposed route corridor. Passive NO_2 diffusion tubes were deployed by NBC on Main Street, Ballynure; however, the site ceased operation at the end of 2006. The site was located approximately 20 m from the A8 and is detailed in Table 97.

Table 97 **Historic Diffusion Tube Monitoring at Ballynure**

Site ID	Location	Type	Annual Mean Concentrations (µg/m^3)	
			2005	2006
35	Main Street	Roadside	16.6	15.0

As is evident from the NO_2 monitoring in the vicinity of the A8, pollutant concentrations are well below the UK objective and EU limit Values (40µg/m^3).

14.6.6 Background Pollutant Concentrations

In the UK Air Quality Archive operated by the National Environmental Technology Centre (NETCEN), Defra has produced background air pollution data for 2008 and projections for other years for nitrogen oxides (NO_X), NO_2 and PM_{10} for each 1km by 1km OS grid square[100] Estimated pollutant concentrations across the assessment are mapped in the methodology chapter 14.4.4.1 for the years 2008, 2016 and 2031. Future background air pollutant concentrations are predicted to reduce (see chapter 14.4.4.1) mainly due to the influence of improved vehicle[101] and boiler technology and stricter emissions standards[102].

14.7 Assessment of Effects due to Construction

Atmospheric emissions from construction activities will depend on a combination of the potential for emission (type of activities) and the effectiveness of control measures. In general terms, there are two sources of emissions that will need to be controlled to minimise the potential for adverse environmental effects:

- Exhaust emissions from site plant, equipment and vehicles; and
- Fugitive dust emissions from site activities.

The operation of vehicles and equipment powered by internal combustion engines results in the emission of waste exhaust gases containing the pollutants NO_X, PM_{10}, $PM_{2.5}$, VOCs, and carbon monoxide (CO). The quantities emitted depend on factors such as engine type, service history, pattern of usage and composition of fuel. The operation of equipment, vehicles and machinery within the construction site would result in emissions to the atmosphere of unquantified levels of exhaust gases but such emissions are unlikely to be significant - particularly in comparison to levels of similar emissions from construction traffic on public roads. Therefore emissions of site plant and equipment have not been considered any further in this assessment. The following section focuses on addressing construction traffic emissions (offsite effects) and dust nuisance potential.

[101] Measures to be Taken Against Air Pollution by Emissions from Motor Vehicles Directive 70/220/EEC and Daughter Directives
[102] Boiler Efficiency Directive 92/42/EEC

14.7.1 Construction Traffic Emissions

14.7.1.1 Forecast Pollutant Concentrations

Forecast pollutant concentrations are presented in detail in **Appendix I, ES Volume II**, for all the modelled receptors, for comparison with relevant air quality objectives and limit values as shown in Table 85. A summary of the results is presented below for each of the pollutants considered in the modelling.

14.7.1.2 Nitrogen Dioxide in 2014

Forecast changes in annual mean NO_2 concentrations in the year 2014 with the magnitude of these changes are described in Table 98.

Table 98 **Change in Annual Mean NO_2 Concentrations and Significance of Change with Proposed Scheme at Construction Assessment Receptors in 2014**

Receptor	Change (µg/m^3)	Relative Change	Significance
6	1.2	Small Increase	Negligible
8	0.1	Imperceptible Increase	Negligible
10	1.2	Small Increase	Negligible
12	0.9	Small Increase	Negligible
14	0.5	Small Increase	Negligible
17	0.6	Small Increase	Negligible
21	1.2	Small Increase	Negligible

The annual mean NO_2 concentrations are forecast to be below the national objective value (40 µg/m^3) at all receptors in all scenarios.

The magnitude of forecast change in NO_2 as a result of the proposed development in 2014 equates to a small increase (0.4-2.0 µg/m^3) at six of the receptors and an imperceptible increase (<0.4 µg/m^3) at one of the receptors.

These descriptors have been used to assess the significance of the effect in relation to the absolute concentration forecast from the assessment. With regard to NO_2, the effect of the development is identified as negligible in the year 2014.

14.7.1.3 Fine Particulate Matter in 2014

Forecast changes in annual mean PM_{10} concentrations in the year 2014 with the magnitude and significance of these changes are presented in Table 99.

Table 99 **Change in Annual Mean PM_{10} Concentrations and Significance of Change with Proposed Scheme at Construction Assessment Receptors in 2014**

Receptor	Change (µg/m^3)	Relative Change	Significance
6	0.1	Imperceptible Increase	Negligible
8	0.0	No Change	Negligible
10	0.1	Imperceptible Increase	Negligible
12	0.1	Imperceptible Increase	Negligible

Receptor	Change (µg/m^3)	Relative Change	Significance
14	0.0	No Change	Negligible
17	0.1	Imperceptible Increase	Negligible
21	0.1	Imperceptible Increase	Negligible

The annual mean PM_{10} concentrations are forecast to be below the national objective value (40µg/m^3) at all receptors in all scenarios.

The magnitude of forecast change in PM_{10} as a result of the proposed development in 2014 equates to an imperceptible increase (<0.4 µg/m^3) at five of the receptors and no change at two of the receptors.

With regard to PM_{10}, the significance of effect of the development is identified as ***negligible*** in the year 2014.

All receptors are predicted to not experience any days where the average PM_{10} concentration is above 50 µg/m^3. The significance of effect is ***negligible*** at all receptors.

14.7.1.4 Overall Assessment of Significance – Construction Vehicle Emissions

EPUK Factors to Judge Significance

With reference to Table 95, the following points are noted:

- The major air quality impacts of construction are limited to the small number of residences which are assessed here, since the stretch of the A8 experiencing traffic increases (according to DMRB) is rural;
- These receptors mostly experience small increases in NO_2 concentrations and imperceptible changes in PM_{10} concentrations;
- No new exposure (sensitive receptors) is being introduced to the area as a result of construction; and
- No exceedances of the statutory air quality objectives and limit values are predicted as a result of the construction of the scheme.

Based on these findings, the overall impact of the construction of the scheme on air quality is ***insignificant***.

EPUK Steps to Assess Significance Flowchart

Using the EPUK flowchart, shown in Figure 16, the following points are noted:

- Modelling shows that the A8 Dualling would not breach an EU limit value or air quality objective;
- The A8 Dualling would not affected the implementation of an Action Plan or local air quality strategy; and
- Modelling does not demonstrate significant degradation of air quality at any of the modelled receptors.

Based on this air quality during construction is a ***low priority*** consideration with regards to the planning process.

14.7.2 Dust Nuisance

Monitoring and assessment of construction sites in the UK indicates that any elevation in dust deposition rates (which can lead to dust nuisance) or ambient concentrations of particulates (PM_{10}) is normally limited to within 200 metres of a worksite boundary. Therefore, if sensitive receptors are present within this distance then there is potential for air quality impacts if the site is not well managed. Sensitive receptors include residential units, schools, hospitals and care homes.

Fugitive dust emissions from construction activities are likely to be variable and would depend upon type and extent of the activity, soil conditions (soil type and moisture), road surface condition and weather conditions. Soils are inevitably drier during the summer period and periods of dry weather combined with higher than average winds have the potential to generate the most dust. The construction activities that are the most significant sources of fugitive emissions in the construction scheme are:

- Demolition activities, due to the breaking up of concrete along the existing carriageway;
- Saw cutting the existing carriageway at temporary tie-ins to the existing carriageway;
- Concrete crushing on site compounds to re-use existing carriageway;
- Earth moving, due to the excavation, handling, storage and disposal of soil and subsoil materials;
- Construction aggregate usage, due to the transport, unloading, storage and use of dry and dusty materials (such as cement powder and sand); ;
- Movement of heavy site vehicles on dry untreated or hard surfaced surfaces; and
- Movement of vehicles over surfaces contaminated by muddy materials brought off the site - for example, over public roads.

There are 161 residential receptors within 200 m of the A8 Dualling works. Table 100 provides a classification of the different distance bands.

Table 100 **Number of Sensitive Receptors within 200 m of the A8 Dualling Works**

Distance from site boundary	No of sensitive receptors
0 – 25m	34
25 – 50m	40
50m – 100m	40
100m – 200m	47

According to the criteria specified in Table 90, the potential for dust nuisance experienced by the receptors within 25m and within 50 m is considered high, whilst the dust nuisance potential for receptors within 100 m and within 200 m is considered to be medium and low, respectively. Due to the high dust nuisance potential at 34 receptors, the potential for dust to have a significant impact on sensitive receptors is ***high*** regardless of the length of construction period or methods applied.

In addition to construction activities carried out along the road corridor, construction compounds will be set up to accommodate construction activities as well as material storage, parking of vehicles and site plant. Due to the proximity of sensitive receptors to the existing A8, the potential for dust nuisance has been assessed as high and appropriate mitigation measures should feed into the CoCP and be employed by the contractor.

The GLA Best Practice Guidance notes that the implementation of the suggested mitigation measures will help reduce the impact of construction activities to a ***medium*** or even ***low*** risk. Construction mitigation measures are further discussed in the chapter 14.8.

14.8 Mitigation of Effects due to Construction

Since the effect of construction vehicle traffic is insignificant or low priority, no vehicle emission specific measures are considered necessary for this scheme.

Effective dust mitigation measures prevent dust becoming airborne or contain dust within enclosures to prevent dispersion beyond the emission source and should be considered.

Prior to commencement of construction activities, agreement should be reached with NBC and LBC to ensure the potential for adverse environmental effects on local receptors is minimised. This includes measures to control traffic, site access points and hours of operations. It is recommended that the measures for controlling dust and general pollution nuisance from the site construction operations outlined in the COCP are adhered. These controls should be applied throughout the construction period to ensure that dust emissions are mitigated. Thus the construction activities would be controlled to reduce as far as possible the potential environmental impacts. Recommended mitigation measures are given in **Appendix I, ES Volume II**.

Implementation of the agreed CoCP (see chapter 5.8) would ensure that effects would be reduced as far as practicable and dust nuisance would be unlikely.

14.9 Residual Effects due to Construction

The residual effects of construction activities associated with the proposed development would be ***medium*** to ***low*** risk after mitigation and would occur on a short to medium term basis only. It is anticipated that there are no long term residual effects related to the construction of the proposed scheme.

14.10 Cumulative Effects due to Construction

Regarding the construction traffic assessment, traffic data for 2016 included cumulative traffic from the Drumahoe Inward Investment Site (as identified in chapter 16.5.2.4). No other developments were considered of a large enough scale to significantly impact the local road network.

Dust nuisance from the scheme may be compounded by existing activities at the Loughside Quarry at the northern end of the scheme. This area however is sparsely populated with very few residential properties in close proximity to both the A8 and the quarry. Additionally, the scheme has already been identified as a high risk site with regard to dust nuisance.

14.11 Assessment of Effects due to Operation

14.11.1.1 Forecast Pollutant Concentrations

Forecast pollutant concentrations are presented in **Appendix I, ES Volume II** for all the modelled receptors, for comparison with relevant air quality objectives. A summary of the results is presented below for each of the pollutants considered in the modelling.

14.11.1.2 Nitrogen Dioxide in 2016

Forecast changes in annual mean NO_2 concentrations in the year 2016 with the magnitude of these changes, as described in Table 101 and significance of impact on air quality, as described in Table 92 and Table 93.

Table 101 **Change in Annual Mean NO_2 Concentrations and Significance of Change with Proposed Development at Modelled Receptors in 2016**

Receptor	Change (μg/m^3)	Relative Change	Significance
1	-0.1	Imperceptible Decrease	Negligible
2	0.0	No Change	Negligible
3	0.0	No Change	Negligible
4	0.3	Imperceptible Increase	Negligible
5	-0.1	Imperceptible Decrease	Negligible
6	0.0	No Change	Negligible
7	-0.1	Imperceptible Decrease	Negligible
8	4.9	Large Increase	Slight Adverse
9	-0.1	Imperceptible Decrease	Negligible
10	-5.9	Large Decrease	Slight Beneficial
11	0.0	No Change	Negligible
12	-1.2	Small Decrease	Negligible
13	-0.1	Imperceptible Decrease	Negligible
14	-0.1	Imperceptible Decrease	Negligible
15	-0.1	Imperceptible Decrease	Negligible
16	0.0	No Change	Negligible
17	1.9	Small Increase	Negligible
18	0.0	No Change	Negligible
19	0.0	No Change	Negligible
20	Acquired by agreement/vesting		
21	-7.6	Large Decrease	Slight Beneficial
22	0.0	No Change	Negligible
23	-9.5	Large Decrease	Slight Beneficial

Receptor	Change (µg/m^3)	Relative Change	Significance
24	0.8	Small Increase	Negligible
25	0.0	No Change	Negligible
26	2.7	Medium Increase	Negligible
27	0.3	Imperceptible Increase	Negligible
28	-3.8	Medium Decrease	Negligible
29	1.4	Small Increase	Negligible
30	-0.1	Imperceptible Decrease	Negligible
31	0.9	Small Increase	Negligible
32	0.5	Small Increase	Negligible
33	0.0	No Change	Negligible
34	0.0	No Change	Negligible
35	-0.1	Imperceptible Decrease	Negligible
36	1.5	Small Increase	Negligible
37	-1.9	Small Decrease	Negligible
38	-0.3	Imperceptible Decrease	Negligible
39	0.1	Imperceptible Increase	Negligible
40	-0.5	Small Decrease	Negligible
41	-3.7	Medium Decrease	Negligible
42	-0.1	Imperceptible Decrease	Negligible
43	-0.1	Imperceptible Decrease	Negligible
44	0.3	Imperceptible Increase	Negligible
45	0.5	Small Increase	Negligible
46	0.5	Small Increase	Negligible
47	-0.3	Imperceptible Decrease	Negligible
48	0.1	Imperceptible Increase	Negligible

The annual mean NO_2 concentrations are forecast to be below the national objective value (40 µg/m^3) at all receptors in both scenarios.

In terms of the change in the 2016 NO_2 annual mean concentrations (i.e. difference between Do Minimum and Do Something scenarios) as a result of the proposed scheme, Receptor 8 experiences the largest increase of 4.9 µg/m^3. 14 other receptors experience lesser increases in NO_2 concentrations. Receptor 23 experiences the largest decrease of 9.5 µg/m^3. 20 other receptors experience lesser decreases in NO_2 concentrations. The 11 remaining receptors experience no changes in NO_2 concentrations.

The magnitude of forecast change in NO_2 as a result of the proposed scheme in 2016 equates to a large increase (> 4.0 µg/m^3) at one of the receptors, a medium increase (2.0-4.0 µg/m^3) at one of the receptors, a small increase (0.4-2.0 µg/m^3) at eight of the receptors, an imperceptible increase (< 0.4 µg/m^3) at five of the receptors, no change at 11 of the receptors, an imperceptible decrease (< 0.4 µg/m^3) at 13 of the receptors, a small decrease (0.4-2.0 µg/m^3) at three of the receptors, a medium decrease (2.0-4.0 $\mu g/m^3$) at two of the receptors and a large decrease (> 4.0 $\mu g/m^3$) at three of the receptors.

These descriptors are then used to assess the significance of the effect in relation to the absolute concentration forecast from the assessment. With regard to NO_2, the effect of the development is identified as ***slight beneficial*** to ***slight adverse*** in the year 2016.

14.11.1.3 Fine Particulate Matter in 2016

Forecast changes in annual mean PM_{10} concentrations in the year 2016 with the magnitude and significance of these changes are presented in Table 102.

Table 102 **Change in Annual Mean PM_{10} Concentrations and Significance of Change with Proposed Development at Modelled Receptors in 2016**

Receptor	Change ($\mu g/m^3$)	Relative Change	Significance
1	0.0	No Change	Negligible
2	0.0	No Change	Negligible
3	0.0	No Change	Negligible
4	0.1	Imperceptible Increase	Negligible
5	0.0	No Change	Negligible
6	0.1	Imperceptible Increase	Negligible
7	0.0	No Change	Negligible
8	0.9	Small Increase	Negligible
9	0.0	No Change	Negligible
10	-0.7	Small Decrease	Negligible
11	0.0	No Change	Negligible
12	0.1	Imperceptible Increase	Negligible
13	-0.1	Imperceptible Decrease	Negligible
14	0.2	Imperceptible Increase	Negligible
15	-0.1	Imperceptible Decrease	Negligible
16	0.0	No Change	Negligible
17	0.5	Small Increase	Negligible
18	0.0	No Change	Negligible
19	0.0	No Change	Negligible
20	Acquired by agreement/vesting		
21	-1.1	Small Decrease	Negligible
22	-0.1	Imperceptible Decrease	Negligible
23	-1.3	Small Decrease	Negligible
24	0.1	Imperceptible Increase	Negligible
25	0.0	No Change	Negligible
26	0.5	Small Increase	Negligible
27	0.0	No Change	Negligible

Receptor	Change (µg/m^3)	Relative Change	Significance
28	0.0	No Change	Negligible
29	0.5	Small Increase	Negligible
30	-0.1	Imperceptible Decrease	Negligible
31	0.5	Small Increase	Negligible
32	0.2	Imperceptible Increase	Negligible
33	0.0	No Change	Negligible
34	0.0	No Change	Negligible
35	0.0	No Change	Negligible
36	0.4	Small Increase	Negligible
37	0.2	Imperceptible Increase	Negligible
38	-0.1	Imperceptible Decrease	Negligible
39	0.0	No Change	Negligible
40	-0.1	Imperceptible Decrease	Negligible
41	-0.3	Imperceptible Decrease	Negligible
42	0.0	No Change	Negligible
43	0.0	No Change	Negligible
44	0.1	Imperceptible Increase	Negligible
45	0.6	Small Increase	Negligible
46	0.2	Imperceptible Increase	Negligible
47	-0.1	Imperceptible Decrease	Negligible
48	0.0	No Change	Negligible

The annual mean PM_{10} concentrations are forecast to be below the national objective value (40µg/m^3) at all receptors in both scenarios.

In terms of the change in the 2016 PM_{10} annual mean concentrations (i.e. difference between Do Minimum and Do Something scenarios) as a result of the proposed scheme, Receptor 8 experiences the largest increase of 0.9 µg/m^3. 15 other receptors experience lesser increases in PM_{10} concentrations. Receptor 23 experience the largest decrease of 1.3 µg/m^3. Ten other receptors experience lesser decreases in PM_{10} concentrations. The 20 remaining receptors experience no change in PM_{10} concentrations.

The magnitude of forecast change in PM_{10} as a result of the proposed scheme in 2016 equates to a small increase (0.4-2.0 µg/m^3) at seven of the receptors, an imperceptible increase (< 0.4 µg/m^3) at nine of the receptors, no change at 20 of the receptors, an imperceptible decrease (< 0.4 µg/m^3) at eight of the receptors and a small decrease (0.4-2.0 µg/m^3) at three of the receptors.

With regard to PM_{10}, the significance of effect of the development is identified as ***negligible*** in the year 2016.

There are no exceedances of the daily mean PM_{10} objective in either the 2016 Do Minimum or 2016 Do Something scenarios.

14.11.1.4 Nitrogen Dioxide in 2031

Forecast changes in annual mean NO_2 concentrations in the year 2031 with the magnitude and significance of these changes are presented in Table 103.

Table 103 **Change in Annual Mean NO_2 Concentrations and Significance of Change with Proposed Scheme at Modelled Receptors in 2031**

Receptor	Change (μg/m^3)	Relative Change	Significance
1	0.0	No Change	Negligible
2	0.0	No Change	Negligible
3	0.0	No Change	Negligible
4	0.2	Imperceptible Increase	Negligible
5	0.0	No Change	Negligible
6	-0.1	Imperceptible Decrease	Negligible
7	0.0	No Change	Negligible
8	4.8	Large Increase	Slight Adverse
9	-0.1	Imperceptible Decrease	Negligible
10	-6.1	Large Decrease	Slight Beneficial
11	0.0	No Change	Negligible
12	-1.4	Small Decrease	Negligible
13	-0.1	Imperceptible Decrease	Negligible
14	-0.1	Imperceptible Decrease	Negligible
15	-0.1	Imperceptible Decrease	Negligible
16	-0.1	Imperceptible Decrease	Negligible
17	1.8	Small Increase	Negligible
18	0.1	Imperceptible Increase	Negligible
19	0.0	No Change	Negligible
20	Acquired by agreement/vesting		
21	-6.9	Large Decrease	Slight Beneficial
22	-0.2	Imperceptible Decrease	Negligible
23	-9.4	Large Decrease	Slight Beneficial
24	0.9	Small Increase	Negligible
25	0.0	No Change	Negligible
26	2.9	Medium Increase	Negligible
27	0.2	Imperceptible Increase	Negligible
28	-2.9	Medium Decrease	Negligible
29	1.9	Small Increase	Negligible
30	-0.3	Imperceptible Decrease	Negligible
31	1.0	Small Increase	Negligible
32	0.4	Small Increase	Negligible
33	0.0	No Change	Negligible

Receptor	Change (µg/m^3)	Relative Change	Significance
34	-0.1	Imperceptible Decrease	Negligible
35	0.0	No Change	Negligible
36	1.5	Small Increase	Negligible
37	-1.7	Small Decrease	Negligible
38	-0.6	Small Decrease	Negligible
39	0.1	Imperceptible Increase	Negligible
40	-0.7	Small Decrease	Negligible
41	-3.5	Medium Decrease	Negligible
42	-0.1	Imperceptible Decrease	Negligible
43	0.0	No Change	Negligible
44	0.3	Imperceptible Increase	Negligible
45	0.7	Small Increase	Negligible
46	0.5	Small Increase	Negligible
47	-0.3	Imperceptible Decrease	Negligible
48	0.0	No Change	Negligible

The annual mean NO_2 concentrations are forecast to be below the national objective value (40 µg/m^3) at all receptors in both scenarios.

In terms of the change in the 2031 NO_2 annual mean concentrations (i.e. difference between Do Minimum and Do Something scenarios) as a result of the proposed development, Receptor 8 experiences the largest increase of 4.8 µg/m^3. 14 other receptors experience lesser increases in NO_2 concentrations. Receptor 23 experiences the largest decrease of 9.4 µg/m^3. 19 other receptors experience lesser decreases in NO_2 concentrations. The 12 remaining receptors experience no changes in NO_2 concentrations.

The magnitude of forecast change in NO_2 as a result of the proposed development in 2031 equates to a large increase (>4.0 µg/m^3) at one of the receptors, a medium increase (2.0-4.0 µg/m^3) at one of the receptors, a small increase (0.4-2.0 µg/m^3) at eight of the receptors, an imperceptible increase (<0.4 µg/m^3) at five of the receptors, no change at 12 of the receptors, an imperceptible decrease (<0.4 µg/m^3) at 11 of the receptors, a small decrease (0.4-2.0 µg/m^3) at four of the receptors, a medium decrease (2.0-4.0 µg/m^3) at two of the receptors and a large decrease (> 4.0 µg/m^3) at three of the receptors.

With regard to NO_2, the effect of the development is identified as ***slight beneficial*** to ***slight adverse*** in the year 2031.

14.11.1.5 Fine Particulate Matter in 2031

Forecast changes in annual mean PM_{10} concentrations in the year 2031 with the magnitude and significance of these changes are presented in Table 56.

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Table 104 **Change in Annual Mean PM_{10} Concentrations and Significance of Change with Proposed Scheme at Modelled Receptors in 2031**

Receptor	Change (µg/m^3)	Relative Change	Significance
1	0.0	No Change	Negligible
2	0.0	No Change	Negligible
3	0.0	No Change	Negligible
4	0.1	Imperceptible Increase	Negligible
5	0.0	No Change	Negligible
6	0.0	No Change	Negligible
7	0.0	No Change	Negligible
8	0.9	Small Increase	Negligible
9	0.0	No Change	Negligible
10	-0.7	Small Decrease	Negligible
11	0.0	No Change	Negligible
12	0.2	Imperceptible Increase	Negligible
13	-0.1	Imperceptible Decrease	Negligible
14	0.1	Imperceptible Increase	Negligible
15	0.0	No Change	Negligible
16	0.0	No Change	Negligible
17	0.6	Small Increase	Negligible
18	0.0	No Change	Negligible
19	0.0	No Change	Negligible
20	Acquired by agreement/vesting		
21	-1.1	Small Decrease	Negligible
22	0.0	No Change	Negligible
23	-1.3	Small Decrease	Negligible
24	0.2	Imperceptible Increase	Negligible
25	0.0	No Change	Negligible
26	0.5	Small Increase	Negligible
27	0.0	No Change	Negligible
28	0.1	Imperceptible Increase	Negligible
29	0.5	Small Increase	Negligible
30	-0.1	Imperceptible Decrease	Negligible
31	0.5	Small Increase	Negligible
32	0.2	Imperceptible Increase	Negligible
33	0.0	No Change	Negligible
34	0.0	No Change	Negligible
35	0.0	No Change	Negligible
36	0.5	Small Increase	Negligible
37	0.3	Imperceptible Increase	Negligible

Receptor	Change (µg/m^3)	Relative Change	Significance
38	-0.2	Imperceptible Decrease	Negligible
39	0.0	No Change	Negligible
40	-0.2	Imperceptible Decrease	Negligible
41	-0.2	Imperceptible Decrease	Negligible
42	0.0	No Change	Negligible
43	0.0	No Change	Negligible
44	0.0	No Change	Negligible
45	0.7	Small Increase	Negligible
46	0.3	Imperceptible Increase	Negligible
47	0.0	No Change	Negligible
48	0.0	No Change	Negligible

The annual mean PM_{10} concentrations are forecast to be below the national objective value (40µg/m^3) at all receptors in both scenarios.

In terms of the change in the 2031 PM_{10} annual mean concentrations (i.e. difference between Do Minimum and Do Something scenarios) as a result of the proposed development, Receptor 8 experiences the largest increase of 0.9 µg/m^3. 14 other receptors experience lesser increases in PM_{10} concentrations. Receptor 23 experience the largest decrease of 1.3 µg/m^3. Seven other receptors experience lesser decreases in PM_{10} concentrations. The 24 remaining receptors experience no change in PM_{10} concentrations.

The magnitude of forecast change in PM_{10} as a result of the proposed development in 2031 equates to a small increase (0.4-2.0 µg/m^3) at seven of the receptors, an imperceptible increase (<0.4 µg/m^3) at eight of the receptors, no change at 24 of the receptors, an imperceptible decrease (<0.4 µg/m^3) at five of the receptors and a small decrease (0.4-2.0 µg/m^3) at three of the receptors.

With regard to PM_{10}, the significance of effect of the development is identified as ***negligible*** in the year 2031.

There are no exceedances of the daily mean PM_{10} objective in either the 2031 Do Minimum or 2031 Do Something scenarios.

14.11.1.6 Very Fine Particulate Matter ($PM_{2.5}$)

Annual mean concentrations of PM_{10} fall below the annual mean $PM_{2.5}$ air quality objective (25 µg/m^3) at all modelled locations in all scenarios. Since $PM_{2.5}$ is a subset of PM_{10}, it follows that the annual mean $PM_{2.5}$ objective will be met at all modelled receptors in both 2016 and 2031.

14.11.1.7 Disparity Between Predicted Changes in NO_2 and PM_{10} Annual Mean Concentrations

It can be observed at Receptor 12, Receptor 14, Receptor 28 (in 2031 only) and Receptor 37 that annual mean NO_2 concentrations decrease between the Do

Minimum and Do Something scenarios whereas annual mean PM_{10} concentrations increase.

At these receptors the road alignment shifts so that these receptors become further away from the road, which if considered alone would decrease concentrations at receptors. However due to the increased capacity of the road, vehicle speeds are predicted to increase, which would increase emissions from vehicles and hence pollutant concentrations at receptors.[103]

With increasing distance from roads, road contributions to concentrations of both PM_{10} and NO_2 decrease by the same proportion. An increase in vehicle speed however increases PM_{10} emissions by a much larger proportion than NO_2 emissions. For example, the DMRB model predicts that in 2020, an increase in speed from 70 km/h to 100 km/h will result in an increase in PM_{10} emissions from cars of 85% while NO_2 emissions would only increase by 35%.

The combined effect of the increased distance from the road and the increase in vehicle speeds results in an overall increase in PM_{10} concentrations and an overall decrease in NO_2 concentrations at these receptors.

14.11.1.8 Overall Assessment of Significance – Local Air Quality

EPUK Factors to Judge Significance

With reference to Table 95, the following points are noted:

- The major air quality impacts of the scheme are limited to a small number of residences considering the scale of the scheme since the stretch of the A8 to be modified is within a rural setting. Only 34 residential properties lie within 25m of the proposed dualled carriageway, and 161 within 200 m (see Table 100). Major impacts would be both adverse and beneficial;
- More minor air quality impacts would encompass a much wider area, with roads local to the A8 and stretches of the A8 not under modification experiencing changes in traffic flows and characteristics. Impacts are still limited to a rural area with a low density population;
- No new exposure (sensitive receptors) is being introduced to the area as a result of the scheme. Two residences would be removed by agreement or vesting;
- The magnitudes of change and significance vary widely throughout the scheme with the greatest changes experienced where the A8 is realigned. Both adverse and beneficial effects are seen which vary from large decreases to large increases. On the whole beneficial and adverse effects are more or less balanced (see chapter 14.11.1.2 to 14.11.1.5); and
- No exceedances of the statutory air quality objectives and limit values are predicted as a result of the scheme.

Based on these findings, the overall impact of the scheme on air quality would be ***minor***.

[103] (At speeds over 50 kph, increasing the vehicle speed on average produces more pollutants over a set distance since the engines are not running as optimally).

EPUK Steps to Assess Significance Flowchart

Using the EPUK flowchart, shown in Figure 16, the following points are noted:

- Modelling shows that the A8 Dualling would not breach an EU limit value or air quality objective;
- The A8 Dualling would not affected the implementation of an Action Plan or local air quality strategy; and
- Modelling does demonstrate significant degradation of air quality at some receptors.

Based on this air quality is a ***medium*** priority consideration with regards to the planning process.

14.11.1.9 Regional Air Quality

Total emissions of NO_X, PM_{10}, $PM_{2.5}$ and CO_2 were calculated using the DMRB regional impact assessment spreadsheet. The results are presented in Table 105.

Table 105 **Total Pollutant Emissions**

Pollutant	**2008**	**2016**			**2031**		
		Do Minimum	**Do Something**	**Change (%)**	**Do Minimum**	**Do Something**	**Change (%)**
NOx (kg/yr)	132375	82774	97434	17.7	83301	99356	19.3
PM_{10} (kg/yr)	3496	1973	2809	42.4	2070	3044	47.1
$PM_{2.5}$ (kg/yr)	3146	1776	2528	42.4	1863	2740	47.1
CO_2 (Tonnes/yr)	31133	32277	38698	19.9	34348	41685	21.4
VKT (Km)	315689	353966	390678	10.4	385967	428736	11.1
Note: These emissions are based on all links provided by the transport engineers							
VKT – vehicle kilometres travelled							

The results in Table 105 show that total vehicle kilometres travelled would increase in both 2016 and 2031. However, greater percentage increases in NO_X, PM_{10}, $PM_{2.5}$ and CO_2 emissions with the scheme in both 2016 and 2031 are observed.

These increases can be explained by the increases in speed with the dual carriageway allowing a greater maximum speed and relieving congestion. The average speed of vehicles on the assessed network would, as a result of the dualling, increase from 81 kph to 98 kph in 2016 and from 81 kph to 99 kph in 2031. At higher speeds over 50 kph, vehicles on average produce more pollutants over a set distance since the engines are not running as optimally[87]. The increase in emission rates at higher speeds is proportionally greatest with particulate matter with smaller proportional increases for both NO_X and CO_2 (as explained in chapter 14.11.1.7).

There is a significant decrease in NO_X and PM_{10} emissions per vehicle kilometre travelled when comparing the 2008 and 2016 scenarios as a result of ongoing improvements in vehicle emissions technology driven by European emissions standard directives. Between 2016 and 2031 this improvement slows as emission reduction technology is projected to mature.

14.12 Mitigation of Effects due to Operation

Since the significance of effects are slight adverse at worst, and since all concentrations in the 2016 and 2031 Do Something scenarios are well below the NO_2 and PM_{10} objective concentrations, no mitigation regarding operation is proposed.

14.13 Residual Effects due to Operation

With no mitigation proposed, residual effects would be those set out in the assessment of significant effects – Operation (chapter 14.11)

14.14 Cumulative Effects due to Operation

The only major development identified as having a significant impact on future year traffic was the Drumahoe Inward Investment Site. Predicted traffic generated from this site was included in the future year scenario traffic used in the assessment of effects due to operation (chapter 14.11).

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15 Effects on All Travellers

15.1 Introduction

This chapter presents an assessment of the Effect on All Travellers as a result of upgrading a 14km stretch of the A8 Belfast to Larne Road from Coleman's Corner to the B100 (Ballyrickard Road), from single carriageway to dual carriageway standard.

The methodology for the assessment of Effect on All Travellers is based on DMRB Volume 11, Section 3, Part 8 '*Pedestrians, Cyclists, Equestrians and Community Effects*', for the assessment of effects on the Pedestrian, Cyclist and Equestrian resource; and DMRB Volume 11, Section 3, Part 9 'Vehicle Travellers' for the assessment of effects on Vehicle Travellers. This change in title is in accordance with the updated DMRB structure for Environmental Assessments as outlined in Volume 11, Section 1, Part 1.

15.2 Legislation and Guidance

There is no national legislation relating to the assessment of effects on travellers. Therefore this assessment has been undertaken utilising the guidance of DMRB as stated above. The assessment has been supplemented by local information from walking and cycling organisations within Northern Ireland as referenced within the chapter.

15.3 Scoping and Consultation

15.3.1 Scoping

An ES Scoping Report was issued in March 2010 to key statutory and non-statutory bodies outlining the approach, methodology, baseline conditions and expected effects of the scheme.

It was circulated to all stakeholders, offering them an opportunity to address the proposed methodologies for the EIA or to address issues that have not been adequately covered. A list of consultees is included in chapter 7.3.

15.3.2 Consultation

As part of this assessment and the Non-Motorised User (NMU) survey, a series of consultation approaches where adopted to establish existing usage along the A8 and identify any concerns of national interest groups and local organised clubs and societies.

Details of the responses of those consulted are detailed within the baseline for each of the groups considered by this assessment.

- Pedestrians – See chapter 15.6.2;
- Cyclists – See chapter 15.6.3; and
- Equestrians – See chapter 15.6.4.

Details of the wider consultation process are detailed within chapter 7 with a summary of issues raised by statutory bodies as part of the Environmental Liaison Group meetings detailed in Table 14.

15.4 Assessment Methodology

The overall approach for the Effect on All Travellers assessment is to examine the existing pedestrian, cyclist, equestrian and vehicle traveller provision, assess the type and level of provision to be provided by the scheme and the resultant effect on all traveller movements. This was completed through the undertaking of a desk based study and a number of site visits to establish the existing facilities and usage.

15.4.1 Methodology for Establishing Baseline Conditions

To establish the baseline conditions, a desk study and site walkover was undertaken to identify the existing pedestrian, cyclist, equestrian and vehicle traveller resource within the scheme assessment area. This included:

- Site visits to identify existing routes, public rights of way, cycle routes and equestrian facilities where present;
- Consultation with cycling, equestrian clubs and societies to identify existing facilities and usage within the area;
- Review of the Non-Motorised Users Survey (NMU) undertaken by Arup. The full NMU report is included within **Appendix J, ES Volume II**; and
- Establishing the existing view from the road and identifying existing factors which contribute to driver stress when travelling along the road.

15.4.2 Methodology for Assessment of Effects due to Construction and Operation

A qualitative assessment of effects due to construction and operation upon all travellers was undertaken following the guidance of DMRB Volume 11, Section 3, Parts 8 and 9. In addition, the view of local groups who may be affected by the scheme was also sought. The assessment of effects for both scenarios is based upon the same qualitative methodology.

The effects on pedestrians, cyclists and equestrians considered the effect of the proposed dualling upon the existing facilities within the scheme assessment area and upon identified important routes.

The assessment of effects upon vehicle travellers considered the following:

- Effect of construction/operation upon drivers ‘View from the Road’; and
- Effect of construction/operation upon ‘Driver Stress’.

Both the assessment of effects due to construction and operation have considered the potential for the creation of new severance and relief of severance as a result of the dualling scheme.

15.4.3 Significance Criteria

The assessment of effects for both construction and operation upon vehicle travellers and non-motorised users has been determined and assessed using the significance criteria detailed in Table 9 to Table 13, in chapter 6 'Approach and Methods'.

The assessment of 'new severance' caused by a proposed road scheme is assessed using the following three-point scale as defined in DMRB Volume 11, Section 3, Part 8 (See Table 106).

Table 106 **New Severance Significance Criteria**

Effect	Description of Effect
Slight	In general the current journey pattern is likely to be maintained, but there will probably be some hindrance to movement.
Moderate	Some residents, particularly children and elderly people, are likely dissuaded from making trips. Other trips will be made longer or less attractive.
Severe	People are likely to be deterred from making trips to an extent sufficient to induce a re-organisation of their habits. This would lead to a change in the location of centres of activity or in some cases to a permanent loss to a community. Alternatively, considerable hindrance will be caused to people trying to make their existing journeys.

The assessment of relief from severance is determined using the scale identified in Table 107.

Table 107 **Level of Relief of Severance scale**

Type of Area	Level of Relief of Severance		
	Slight	Moderate	Substantial
Built up Area	c.30%	30-60%	60% +
Rural Area	c.60-75% [104]	75-90% [105]	90% [106]

15.5 Limitations and Assumptions

15.5.1 Limitations

There are considered to be no limitations associated with this assessment.

15.5.2 Assumptions

During the baseline research and consultation activities it was established through consultation with equestrian societies and clubs that there is limited equestrian activity along local side roads with very limited activity on the existing A8 carriageway (see chapter 7.2). Therefore the effects on equestrians are considered

[104] Where the existing road is passing through a village or on the perimeter of a built up area use c.30%.
[105] Where the existing road substantially bisects a village or small town this figure may be halved
[106] Where the existing road substantially bisects a village or small town this figure may be reduced to 60%.

to be negligible and have been scoped out of this assessment. The baseline condition has still been reported in chapter 15.6.4.

15.6 Baseline Conditions

The following baseline conditions have been identified.

15.6.1 Non-Motorised User Survey (NMU)

The aim of the NMU survey is to provide a summary of all available information relevant to existing and potential NMU activity and to provide a baseline to ensure that NMUs are addressed during the scheme design development and subsequent detailed design and construction stages.

This study included manual pedestrian counts and roadside interviews at locations along the route as shown on **Drawings CSK-1186 to 1188 and Drawing CSK-1191, NMU Context Report (Appendices), Appendix J, ES Volume II**.

In addition to the NMU site survey, there have been several site visits by the design and assessment teams during all stages of the scheme assessment. Consultation has also been undertaken with landowners within the assessment area where issues of pedestrian, cyclist and equestrian activity has been raised either by the design team or individual landowners.

15.6.2 Pedestrians

The existing A8 has approximately 6km of footway split over both sides of the road; northbound (referred to as the western carriageway) and southbound (referred to as the eastern carriageway), plus intermittent areas of hard verge which act as informal provision. **Drawing CSK-1189 to 1190, NMU Context Report (Appendices), Appendix J, ES Volume II** displays the footway provision along the existing A8 as well as identifying the route of the Ulster Way, Public Right of Way (PROW) walking trail.

The Ulster Way walking route is a series of PROW paths which cross the Northern Ireland countryside. The route traverses the scheme assessment area and crosses the existing A8 at Ballynure, affording opportunities for physical activity throughout the area. There are no other PROWs within the scheme assessment area.

Table 108 details pedestrian counts recorded during a number of surveys undertaken by the Arup NMU Audit Team.

Table 108 **Existing Pedestrian Counts**

Location	**Total Number of Pedestrians (Recorded between 7:00hrs and 19:00hrs)**
Main Street, Ballynure	16
Riverside, Ballynure	149
Lismenary Road, Ballynure	95

Location	Total Number of Pedestrians (Recorded between 7:00hrs and 19:00hrs)
Petrol Filling Station, Ballynure	5

The existing network of formal footways and shared cycleways along the existing carriageway is considered to be poorly connected. Where formal footways do exist they currently end abruptly often with no further provision other than a grass verge at the side of the main carriageway. An intermittent shared footway and cycleway exists along sections of the eastern carriageway. However, as with the footway provision along the western carriageway, it often ends abruptly with no provision for crossing existing side roads.

Footway provision does improve within the settlement of Ballynure allowing local access to local services and amenities within the village.

There are a limited number of formal pedestrian crossings along the existing A8 carriageway. Current provision exists at the following locations:

- Either side of the Coleman’s Corner roundabout;
- Opposite the Bruslee waste & recycling site;
- Three locations within Ballynure around the Larne Road / Church Road junction;
- Opposite Beattie’s fish & chip shop, Ballynure; and
- Either side of the A57 (Templepatrick Road) / A8 roundabout.

The crossing point within Bruslee has a central refuge island and appropriate lighting columns to facilitate crossing at night. There is one additional island located south of Bruslee, but it is not connected to formal footways on either side of the road.

The remaining four crossing points in Ballynure have central refuge islands, lighting columns, signage, dropped kerbs and tactile paving to facilitate crossing for all pedestrian users. A pedestrian underpass also exists which forms part of the structure which takes the Ballynure Water and the Ulster Way footpath under the existing A8.

There are also several locations at lay-bys or property entrances along the length of the A8 with dropped kerbs, but no central refuge islands, which may currently serve as unofficial crossing points.

Consultation with the Ulster Federation of Rambling Clubs (UFRC) in June 2009, indicated that to their knowledge, of the 32 clubs associated with the organisation, they have no knowledge of any use of the A8 or the Ulster Way. They highlighted that users prefer to walk on quieter ‘B’ and ‘C’ roads citing safety as their key concern.

Existing pedestrian facilities are considered poor given the high frequency of high speed heavy goods vehicles and large farm vehicles which use the road, together with the number of vehicle traffic accidents reported along the road (see Table 112).

15.6.3 Cyclists

There is some provision for cyclists on both sides of the carriageway. The eastern carriageway which travels south-bound from Larne to Belfast has a greater amount of formal pedestrian and cycleways along the road. A shared-use foot and cycle way is clearly signed along parts of the carriageway and is of a good standard. However, there are areas where the path ends abruptly with no further provision along the road for up to several hundred meters, creating an unsafe environment for both pedestrian and cyclists.

In total there is approximately 3.1km of shared cycleway along the existing A8 carriageway.

Consultation was undertaken with a number of cycling organisations and user groups including:

- Sustrans;
- Countryside Access and Activities Network; and
- Local cycling clubs.

A summary of responses when consulted on usage within the scheme assessment area is documented in Table 109.

Table 109 **Summary of consultation with cycling organisations and local clubs**

Consultee	Response
Sustrans	Sustrans confirmed that there is no existing official Sustrans / National Cycle Network, cycleway provision in this area. However, they are working on a scheme to link the Irish National Cycling Network to the Scottish National Cycling Network via the Larne ferry link. Sustrans view was that a good quality segregated cycle path adjacent to the proposed dualling would provide an ideal route for tourists accessing the ferry and Belfast.
Countryside Access and Activities Network (CAAN)	The CAAN promotes cycling in Northern Ireland via their website www.cycleni.com. They confirmed that they currently do not promote the cycleway on the existing A8 due to how busy the road is and that it is unlikely to be used by cyclists.
Ballymena Scotts Road Club (BSRC)	The club confirmed that they use the road approximately once a month on weekends for training in groups of around 14 to 20 cyclists, between the hours of around 9.30 am to 12.30pm. They join the A8 at Ballynure and head in the direction of Larne. In addition to their training runs, the BSRC highlighted the annual 'Reliability Run' as a potential impact on the A8. The route of this run is yet to be confirmed, but it is thought to consist of a long loop from Ballymena to Carnlough, crossing and travelling along sections of the A8. BSRC commented on both the danger and perceived danger of the road at present
East Antrim Cycle Club	The club confirmed that they very rarely use this section of the A8 under consideration. They stated they would usually come off at the B100 (Ballyrickard Road) if travelling southbound, or at the Doagh Road roundabout. Their view is that the existing road is too dangerous, especially at times of heavy HGV traffic. At times when they do use the road, there can be anywhere between 10 and 20 riders. However, they stated they would only cross the road at junctions, never travelling along the length of it.
Old Bleach Cycling Club	The club confirmed that they do not use the road.

Consultee	Response
Phoenix Cycling Club	The club confirmed that they regularly travel along and cross the A8, although they stated that it is “very busy and dangerous”. There are usually between 8 and 25 riders travelling together. The club previously held time trials held on the road, although they have since been abandoned due to safety concerns.
Chain Reaction Cycles	The club confirmed that they use the existing A8 twice a week, for both club and staff cycle runs. On any given evening, there may be between 2 and 10 riders in the group. Their use of the road varies depending on which route they choose, and hence they travel both along and across the road. At the moment, the road is only used for training purposes. However, they have stated that the club is considering the future use of the road for road cycle events. The club’s run times are usually between 6pm and 8pm mid-week, with occasional use on weekends.
The Ulster Handcycling Association (UHA)	Members of the UHA confirmed that they would not use the road due to heavy traffic and safety concerns.
Other Groups Consulted	
Northern Ireland Cycling Initiative Cycling Ireland Cycling Ulster Ballymena Road Club Kings Moss Cycling Club Slane Cycles Cycling Club Kilbride Cycling Club	No response has been received from these organisations to date.

15.6.4 Equestrians

There are a number of equestrian signs on display along the north-bound verge at its most southerly section from Coleman’s Corner to Ballynure suggesting the use of the area for equestrian activities.

Equestrian activity has been recorded on the sideroads adjacent to the main A8 carriageway including on the Lisglass Road, Rushvale Road and the B95 (Calhame Road).

A number of equestrian groups were consulted to establish exiting levels of use of the A8 and the adjacent side roads.

Table 110 details a summary of the responses received.

Table 110 **Summary of consultation with equestrian organisations**

Consultee	Response
British Horse Society Northern Ireland (BHS-NI)	The BHS-NI stated that they know of 10 to 12 families who own horses within the area and may possibly use the route. It was stated that many local equestrians use the sideroads detailed above for recreational purposes. They stated it was unlikely that any riding clubs would use the road. There are a number of livery yards along the road, which may generate equestrian usage. Use of the road is along both the main A8 and side roads. There is no knowledge of any events or competitions held in the vicinity.

Consultee	Response
	The BHS-NI expressed concerns over safety. They would like to see a separate lane created for equestrians, as traffic travelling up to 70mph would frighten horses, and make use of the road impossible. The same was said for crossings, in that it would be difficult for a horse rider to cross a road on which traffic was travelling at such speeds. Any crossing would therefore have to be either under or over the road, or risk alienating equestrians in the area. The officer expressed concerns that due to the increased speeds along the new road, the scheme could be detrimental to the local culture of equestrianism.
Islandmagee Riding Centre	The riding club stated that they do not use the road due to safety concerns regarding the speed of traffic on the road.

15.6.5 Existing Travel Patterns

Due to the rural nature of the scheme and the presence of the existing A8 carriageway, there is a reduced demand for pedestrian and cyclist movement within the scheme assessment area. However, there are a number of facilities located within walking and cycling distance of the two main settlements of Bruslee and Ballynure which may create the potential to encourage people to make journeys on foot or by bicycle. These reasons are referred to as trip generators. The following trip generators have been identified by the NMU survey within the scheme assessment area.

- Services and businesses at Bruslee (Logwood Plant Centre/Snob Logs Coffee Shop/East Antrim Metals/Waste and Recycling Centre/C2K Educational Centre);
- Services and businesses in Ballynure (Local shops, public houses etc);
- Churches and parish facilities within Ballynure;
- Ballynure Primary School;
- Equestrian liveries;
- Bus stops along the A8; and
- Other businesses and facilities along the road (Roads Service Depot / FP McCann Loughside Quarry).

15.6.6 Vehicle Travellers

The DMRB assessment of the impact on Vehicle Travellers considers views from the road, driver care and driver stress.

15.6.6.1 View from the Road

View from the road is concerned with what travellers can see in the surrounding landscape and the attractiveness of the general travelling environment. Given the rural nature of the landscape along the length of the proposed section of the A8 for dualling, the landscape could be described as open and attractive.

The southern section of the assessment area is open with certain sections restricted by hedgerows and residential housing. Views extend across the Three and Six Mile Water Valley LCA which encompasses the settlement of Ballynure.

The northern section of the assessment has a higher scenic value given its proximity to the Antrim Glens and view over the open landscape towards the Antrim Coast and Glens AONB and the Larne Ridgeland LCA. A further description of the landscape character of the area is detailed within chapter 9 ‘Landscape’.

The overall experience of driving along this section of the road is considered to be pleasant.

15.6.6.2 Driver Stress

The DMRB guidance describes driver stress as ‘the mental and physiological effects experienced by a driver traversing a road network’. Driver stress has three main components, frustration, fear of potential collisions and uncertainty relating to the route being followed.

Sections of A8 within the study area were subject to road improvements undertaken in 2000. This has provided sections of good road surfacing, crawler lanes giving safe opportunities to overtake, improved junctions and traffic management through Ballynure.

The road currently caters for high volumes of road traffic leading to platoons of slow-moving HGVs following the unloading of ferries at the Port of Larne. These can form very long lines of traffic with few gaps, limiting the ability to overtake, causing delays and frustrations. Table 111 details the AADT figures for northbound (NB) and southbound (SB) traffic within the scheme assessment area and the percentage of daily traffic which is HGVs.

Table 111 **Existing 2008 Base Year AADT Figures and Percentage HGVs**

Road Description	2008 Base Year			
	AADT NB	AADT SB	% HGV NB	% HGV SB
Ballyearl Road to Ashley Road	8286	7834	9%	13%
Colmans Corner to Lisglass Road	5660	6015	12%	15%
Lisglass Road to Glen Road	5544	5938	13%	15%
Glen Road to Rushvale Road	5544	5937	13%	15%
Rushvale Road to Drumadowney Road	5818	6241	12%	14%
Drumadowney Road to Calharne Road	5559	5975	13%	15%
Calharne Road to Green Road	5809	6418	12%	14%
Green Road to Legaloy Road	5592	5976	12%	15%
A57 roundabout to Main Street	8149	8033	12%	15%
Main Street to Riverside	8128	8033	12%	15%
Riverside to Lismenary Road	8430	8289	12%	15%

Road Description	2008 Base Year			
	AADT NB	AADT SB	% HGV NB	% HGV SB
Junction Lane to Ballygowan Road	7492	7780	13%	16%
Ballygowan Road to Moss Lane west	7394	7634	13%	16%
Moss Lane west to Moss Lane East	7513	7727	13%	16%
Ballygowan Road to Deerpark Road	7519	7769	13%	16%
Deerpark Road to Park Road	6875	7172	12%	16%
Park Road to where existing A8 dualled	6941	7306	12%	16%

Traffic turning right off the A8 from single carriageway sections can also cause delays to following traffic. Overall, particularly during times of high traffic flow, a poor travelling experience is perceived, thereby increasing driver stress and frustration.

Table 112 details the number of road traffic collisions (RTCs) recorded along the existing A8 between the Coleman's Corner roundabout and the B100 (Ballyrickard Road).

Table 112 **Observed RTCs recorded on existing A8**

Time Period	Number of Collisions			Total Number of Accidents
	Fatal	Serious	Slight	
2005-2009	7	10	50	67

Table 113 **RTC casualties recorded on the existing A8**

Time Period	Number of Casualties			Total Number of Casualties
	Fatal	Serious	Slight	
2005-2009	11	25	85	121

As illustrated by Table 112 and Table 113, there have been a number of accidents on the A8 within the scheme assessment area and public consultation responses have indicated a high fear of potential accidents. Particular causes of concern highlighted included right-turns onto the A8 from side roads and turning right off the A8 onto side roads which can involve traffic waiting on the overtaking lane. Public consultation for the A8 Dualling scheme has indicated that local residents wishing to make a right turn on to the A8 frequently make a left turn and carry on to a roundabout or a safe point to make a U-turn, as this is perceived as a quicker and safer options than making a right-turn.

Overall, driver stress associated with driving on the existing section of the A8 could be described as Moderate to High for the majority of the daylight hours, but lower for the night time period.

15.6.7 Public Transport

Public transport services which have been considered by this assessment are those which currently operate using the existing A8 road and which have bus stops located along the route. Current services operating in the area are provided by Translink, Northern Ireland's integrated transport provider for bus and rail services.

The Belfast to Londonderry railway line travels through Larne. However, the line is not affected by the scheme. The current line crosses the A8 near Mossley, approximately 3km south of Coleman's Corner.

Table 114 details the existing Translink bus services which operate within the scheme assessment area.

Table 114 **Existing Translink Bus Services**

Day	Bus Service		
	Goldline Route 256	**Ulsterbus Route 156**	**Ulsterbus Route 154**
Monday – Friday	13 per day NB 15 per day SB	7 per day NB 9 per day SB	7 per day NB 8 per day SB
Saturdays	6 per day NB 6 per day SB	4 per day NB 4 per day SB	No Service
Sundays	2 per day NB 2 per day SB	No Service	No Service
Route Notes			
	Goldline Express Service from Belfast to Larne – Travels from Belfast along A8, through Ballynure on towards Larne. The service follows same route on return journey. Note: Service stops in Ballynure only	Ulsterbus Service from Belfast to Larne - Travels from Belfast along A8, through Ballynure, then on towards Larne. The service follows same route on return journey.	Ulsterbus Service from Antrim Bus centre to Larne - Travels from Antrim to Ballyclare, then joins the A8 to Larne (follows same route on return journey)

***NB = Northbound, SB = Southbound**

School bus services operate to and from Ballyclare in the morning and evening. The current route is along Irish Hill Road, Lisglass Road, Rushvale Road, the existing A8 (Belfast/Larne Road) and Green Road.

There are currently a high number of bus stops serving the existing A8 carriageway. The location of these can be seen on **Drawings CSK-1189 to 1190, NMU Context Report (Appendices), Appendix J, ES Volume II**. Consultation with Translink on the rationalisation of bus stop locations has been undertaken by the design team and the Roads Service and is detailed in the bus stop design, in chapter 15.7.2.

15.7 Environmental Design

As detailed within chapter 5.3.1, the A8 Dualling scheme has progressed with continuous collaboration between the design team and environmental specialists. Through this process, an environmental design has been developed as an integral part of the overall scheme design. These measures have been assessed as part of the scheme and are not considered to be additional mitigation measures.

The following describes the outline proposals for the incorporation of a footway/cycleway and bus stop strategy as part of the scheme design.

15.7.1 Footway and Cycleway Design

The footway and cycleway strategy for the new carriageway has two elements which have been developed for the eastern and western carriageways.

The eastern carriageway will see the creation of a minimum 2.0m wide shared footway and cycleway along its full length with the exception of the Ballynure bypass section to the west of the village. As the carriageway approaches the A57 Templepatrick Road junction, pedestrian and cyclist provision is diverted from the new carriageway through the village to link up with existing provision. The footway and cycleway then rejoins the carriageway via the Ballybracken Road junction and continues along the length of the dualling.

The western carriageway sees the incorporation of an intermittent minimum 1.5m wide footway along lengths of the carriageway to link residential properties with bus stops located along the western carriageway.

The footpath provision would tie into existing side roads footways where they exist.

15.7.2 Bus Stop Design

The bus stop strategy along the new A8 dual carriageway would provide accessible bus stops along the eastern and western carriageways and tie into the major road junctions and footpath provision. The locations are detailed in Table 115.

Table 115 **Proposed Bus Stop Locations**

Location **(Chainage (Ch))**	**Direction of Travel** **NB = Northbound** **SB = Southbound**
Existing provision prior to Coleman’s Corner retained northbound and southbound (No Chainage)	NB/SB
Located on proposed Calhame Road/Green Road Link Road (Off-line to east of Ch2+850)	
Located within the B95 Green Road/ Calhame Road junction (Ch3+050)	

Location (Chainage (Ch))	**Direction of Travel NB = Northbound SB = Southbound**
Located on the existing A8 carriageway within Ballynure. (East of Ch7+500)	NB
Located on the existing A8 carriageway within Ballynure. (East of Ch7+550)	SB
Located within the Moss Road junction (Ch10+100)	NB/SB
Located with the Deerpark Road junction (Ch12+200)	NB/SB
200m south of Shane's Hill Road (Ch14+200)	NB
200m north of B100 (Ballyrickard Road) (No Chainage)	SB

15.8 Assessment of Effects due to Construction

The assessment of effects has been separated into those which would impact upon pedestrians and cyclists and those which would impact upon vehicle travellers.

Effects due to construction are considered to be those resulting from the breaking up of the sections of the existing road and the construction of the new carriageway and its associated junctions.

15.8.1 Pedestrians and Cyclists

As detailed within chapters 15.6.2 and 15.6.3 there is a significant level of existing pedestrian and cyclist provision along the existing carriageway, however, it is poorly connected to other facilities.

Due to the rural nature of the A8 and its surroundings, the potential and desire for pedestrian movement is limited due to the distances required to access services and facilities.

The NMU survey has identified desire lines within the assessment area. A desire line represents a potential demand for walking or cycling such as connecting local facilities (retail, post office or schools). For the purpose of this assessment the NMU survey assumed that the average maximum journey time for any NMU journey is 30 minutes[107]. Therefore the average maximum distance that a

[107] Based upon Sustrans information sheet FF11.

pedestrian is likely to travel is 2km[108], while the limit for a cyclist is assumed to be 5km[109].

The most significant desire lines exist within the settlements of Bruslee and Ballynure as a large proportion of local facilities are located within these areas. Residents within these settlements are likely to generate the most significant pedestrian activity as demonstrated by the number of pedestrians recorded within Ballynure. Chapter 9.11 of the NMU Report (**Appendix J, ES Volume II**) provides a summary of the likely desire lines within the scheme assessment area and wider facilities.

Areas which offer key local facilities such as schools and retail facilities have the greatest potential for pedestrian activity e.g. Bruslee and Ballynure.

Effects upon pedestrians and cyclists during the construction phase would be limited as the dualling would bypass the two main settlements of Bruslee and Ballynure. However, construction work in proximity to both settlements may have the potential to create additional traffic pressures such as increased congestion and numbers of HGV traffic on the road network due to construction vehicle movements. As a result, pedestrian movement within these settlements could be further restricted. However, given the presence of the existing A8 through both settlements and the significant volumes of vehicles which are currently experienced, the effect upon pedestrians and cyclists would be ***slight adverse*** and of ***neutral significance***.

The bypass of Ballynure would divide the existing Church Road into two sections; to the east and west of the new A8. To the east, Church Road would be stopped-up and to the west the remaining section of Church Road would be extended to create a road linked to the A57 Templepatrick Road junction.

During construction, access along Church Road would be retained until the new link road has been constructed. During this time pedestrian and cyclist links to Ballynure village would be possible though may be affected at times by construction activities in the area and may be less desirable due to increased construction traffic. However, due to limited existing formal footways along Church Road the impact to pedestrians and cyclists would be ***negligible***.

Pedestrians who utilise the existing footways outside of the two main settlements are likely to experience more significant effects during the construction phase. The construction of the new carriageway will require a significant area of land on either side of the existing A8 from which to work and construct the new road. Land-take from the east and west of the existing carriageway would result in the loss of sections of footway and cycleway where they currently exist during the construction phase.

During this time pedestrian movement would be restricted or removed without significant additional safety risks. However, given the limited nature of pedestrian movement, the magnitude of the effect upon pedestrians during construction is likely to be ***slight adverse*** and of ***slight significance***.

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[108] Sustrans information sheet FF11 - Based upon an average adult walking speed of 4kph and maximum journey time of 30 minutes. Therefore (4kph / 60 minutes) x 30 minutes = 2km.
[109] Sustrans information sheet FF11 - Based upon an average adult cycling speed of 10kph and an average maximum journey time of 30 minutes. Therefore (10kph / 60 minutes) x 30 minutes = 5km.

The effect upon cyclists during the construction phase is considered to be less significant. As detailed within chapter 15.6.3, cyclist activity within the scheme assessment area is considered to be limited and of low value. Consultation with various cycling clubs and interest groups such as Sustrans, have established that the existing road is perceived as unsafe for cycling due to high traffic volumes, high traffic speeds and high volumes of HGVs using the road. Therefore local cyclists prefer to use quieter side roads for cycling leisure.

Therefore the potential loss of the existing shared footway/cycleway along the eastern carriageway is considered to have a ***slight adverse*** effect, but is of ***neutral significance***.

15.8.2 Vehicle Travellers

The assessment of effects on vehicle travellers is assessed according to DMRB in terms view from the road and driver stress.

15.8.2.1 View from the Road

During the construction phase vehicle travellers would experience significant changes in the visual amenity of the road environment. Chapter 9 ‘Landscape’ provides a detailed assessment of the effects of the A8 Dualling on the landscape and visual amenity.

During construction the significant effects for vehicle travellers would include a reduction in views along the road and across the landscape due to the presence of construction machinery, site compounds and areas of stripped land.

The construction phase would involve an earthworks phase for enabling the construction of the road and the major junctions outlined within chapter 5 ‘The Proposed Scheme’. The construction of the major junctions would restrict views in these locations due to the presence of new structures and embankments.

The location of potential construction compounds have been identified and are identified on **Drawing A8-S3-3001-3010**, in **Appendix B, ES Volume II**. As a result is it likely that they could restrict traveller views in these areas. The full assessment of these areas and their visual impact is discussed in chapter 9.

The construction phase has the potential to restrict traveller movement due to speed restrictions and changes in road layout which may reduce road traffic to a single lane facilitating movement in both directions. This has the potential to generate increased traffic congestion and traffic delays with more significant delays at peak travel times i.e. AM and PM peak travel.

These construction effects are considered to have a ***moderate adverse*** magnitude of impact due to the reduction in visual amenity and route uncertainty. View from the road is considered to be of low value therefore the significance of these effects on view from the road is considered to be ***slight adverse***.

15.8.2.2 Driver Stress

Driver stress is defined as the adverse mental and physiological effects experienced by a driver traversing a road network.

Vehicle travellers would be affected throughout the duration of the construction period. The accommodation works, demolition of parts of the existing road and construction of new sections of road may require traffic management measures along sections of the existing A8. These measures may require sections of road to be reduced to one lane with temporary traffic signals in operation at certain times of the day to provide access in both road directions. Speed restrictions may also be placed along sections of the road where construction activity is underway, causing driver stress.

Where larger sections of the road are under construction, diversions may be put in place via local side roads adjacent to the carriageway. As a result vehicle travellers may incur increased journey times or increased costs of travel during this period due to the loss of this amenity.

As detailed in chapter 5 the scheme design includes the stopping-up of Church Road to the east of the bypass and the creation of a link road to the A57 Templepatrick Road junction to the west. During construction vehicle travellers will be able to travel along Church Road and retain access to the village of Ballynure until the link road and A57 junction have been completed. At this stage traffic travelling from west to east along Church Road would be required to divert onto the link road and via the A57 junction to access Ballynure or the A8. Depending on the direction of travel, some vehicle travellers may choose to use the local side road network to access the A8 travelling north or other settlements.

It is likely that during the construction phase vehicle travellers would experience a greater level of driver stress due to the increased delays along the road, speed restrictions, greater levels of congestion at peak times, and greater levels of uncertainty particularly when the road may be reduced to one lane in sections or diverted onto side roads.

Given the importance of the existing A8 road for vehicle travellers and for access to and from the Port of Larne for commercial road traffic (HGVs), the road has been assessed to be of medium value. The magnitude of impact due to the construction phase has been assessed to be moderate adverse, therefore the significance of the effects upon vehicle travellers is likely to be ***moderate adverse*** due to construction, but of short term duration.

15.8.2.3 Public Transport

Drawings CSK_1112 and CSK 1113 in **Appendix J, ES Volume II**, illustrate the locations of the bus stops located along the existing A8. Chapter 15.6.7 details the existing bus services which utilise the existing A8 and these bus stops. It is likely that the majority of these bus stops with the exception of those located within Ballynure, would be directly affected by the construction phase as the majority are located along the mainline of the existing road.

It is assumed that during the construction period, Translink would provide bus stops at the same locations as with the existing road. However, public transport users would be likely to experience a level of disruption to services as they travel through the scheme area. Likely effects would include delays and increased journey times due to speed restrictions, changes in road layout, diversions and increased levels of congestion at peak times.

The effect of the A8 Dualling on public transport would therefore be ***slight adverse*** given that services would be locally affected and of ***slight significance***.

15.9 Mitigation of Effects due to Construction

The following measures should be considered by the contractor to offset the effects identified within this assessment on pedestrians and vehicle travellers during construction of the scheme.

15.9.1 Pedestrians and Cyclists

The main effect during construction would be the limited availability or loss of existing footways along the carriageway. To minimise the significance of this effect, the following measures should be implemented:

- Advanced warning of temporary and permanent closure of existing footways and cycleways;
- Provision of clear signage of alternative routes, to be provided by the contractor well in advance of the works; and
- Regularly update information so as to advise the general public and allow for the consideration of alternative means of transport and access.

15.9.2 Vehicle Travellers

The following measures should be considered by the contractor to minimise the significance of effects identified within chapter 15.8.2:

- Traffic should be allowed to move as freely as possible during the construction works to avoid increases in driver frustration and stress;
- Information concerning road closures or diversion should be advertised in advance in the local press, via posters in supermarkets and by website or other means of communication such as local radio;
- Diversions should be clearly signposted in order to reduce driver uncertainty; and
- Low level lighting or high visibility reflective screens, advanced signage or bollards of construction areas along the road at night should be implemented to warn vehicle travellers of the road conditions and construction activities (measures to be agreed by the contractor and the Roads Service prior to construction).

15.9.3 Public Transport

It is assumed that during the construction period, Translink would look to serve bus stops at the same locations as with the existing road, with temporary lay-bys provided as required. The detailed operation of Translink services during the construction period would be agreed between Translink, Roads Service and the Contractor.

15.10 Residual Effects due to Construction

The baseline conditions show that driver stress levels are already high on the existing A8. The assessment would suggest that temporary traffic management measures implemented during the construction phase would only add to this. Due to existing levels of driver stress, the addition of the proposed mitigation measures is unlikely to reduce stress levels by any significant degree and thus residual effects are considered to remain the same as those stated in chapter 15.8.2.

15.11 Assessment of Effects due to Operation

The assessment of effects has been separated into those which would impact upon pedestrians and cyclists and those which would impact upon vehicle travellers.

Effects due to operation are considered to be those resulting from the presence of the new road and its associated junctions.

15.11.1 Pedestrians and Cyclists

As detailed within chapters 15.6.2 and 15.6.3 existing pedestrian and cyclist provision is intermittent and poorly connected, limiting pedestrian and cycling movement within the scheme assessment area.

During the operational phase of the scheme, pedestrians would have access to a formal shared footway/cycleway (minimum width of 2m) along the eastern carriageway for the length of the scheme from the Coleman’s Corner roundabout to the B100 (Ballyrickard Road) via the settlement of Ballynure. It was considered that access to the services and facilities of the main settlement within the scheme assessment area would be of greater benefit to pedestrians and cyclists. The NMU survey desire lines indicated that there is a significant link between the services provision and NMU journeys.

The shared footway/cycleway would be incorporated into the major junctions to allow pedestrians and cyclists to cross the carriageway for access to properties and facilities located along the western carriageway.

The western carriageway would include intermittent sections of footway (minimum width of 1.5m). As detailed within chapter 15.7.1 the purpose of the footway to the west is to facilitate the movement of pedestrians and cyclists from properties located along the western carriageway to bus stops and crossing facilities within the major junctions.

As with the shared footway/cycleway, the western footway would be diverted to link up to existing provision for access to the services and facilities within the settlement of Ballynure. Where appropriate, this footway has also been designed to incorporate sections of sideroads where appropriate (See Ch8+800 to Ch9+100).

No footway or cycleway provision would be provided along the bypass section of the dualling after the A57 (Templepatrick Road) junction until the bypass rejoins the online section of the dualling via the Ballybracken Road junction.

DMRB Volume 11, Section 3, Part 8, Chapter 6 considers the effects of ‘New Severance’ created by highway schemes. As detailed in Chapter 15.4.3, new severance is assessed based upon a three point scale (see Table 106).

The bypass of Ballynure would sever Church Road. As detailed in chapter 5, the scheme would create a western link road connecting Church Road to the A57 Templepatrick Road junction, and an eastern section which would be stopped-up.

The eastern section would retain its connectivity to Ballynure during operation; however, access to commercial facilities located to the west of the alignment would be inaccessible via Church Road and would require a diversion via the A57 junction and the new Church Road Link Road or via the local road network (i.e. Lismenary Road and Lower Ballyboley Road). However, given the nature of the facilities to the west of the alignment, it is considered that pedestrian/cyclist journeys to these facilities are likely to be low in number and not significant.

Pedestrians and cyclists who may live to the west of the bypass and who would use Church Road to access Ballynure, would experience a ***severe*** level of new severance due to the proposals. During operation they would be required to undertake a significant diversion via the new link road and the A57 junction or the local side road network to access the local services and facilities of the village. Such facilities include the Ballynure Primary School which is located on Church Road (East), the post office and various shops and places of worship. This would add considerable additional distance and time to journeys for pedestrians and cyclists of greater than 500m and include the negotiation of the A57 junction. As a result pedestrians and cyclists may be deterred from making trips to the extent that would be sufficient to change their existing habits.

A new footway would be available along the new link road to provide safe access to the A57 Templepatrick Road junction and maintain pedestrian connectivity.

The scheme design does not propose to include any at-grade crossings along the carriageway. Therefore any crossings could only be made via the major junctions associated with the scheme. This would considerably increase journey length and time required for pedestrian and cyclist movement across the carriageway within the scheme assessment area. This has the effect of increasing the severance experienced between both sides of the carriageway. It is considered that this additional severance could have a moderate adverse impact as the extra distance and the need to use the junction bridges to access facilities may put off some groups.

As detailed in chapter 15.4.3 the DMRB seeks to assess the potential relief from severance where possible due to the operation of a road scheme. The scheme has been designed to avoid the two main settlements within the scheme assessment area by bypassing Bruslee and Ballynure. This would result in the removal of significant through traffic. Therefore, together with the diversion of new footway/cycleways to link up with existing provision through Ballynure, this would significantly improve pedestrian provision. Table 116 details the predicted average levels of road traffic through the settlement of Ballynure for both the Do Minimum and the Do Something scenarios.

Table 117 shows predicted daily traffic figures and HGV percentages for key sections of the existing A8 northbound (NB) and southbound (SB) due to the operation of the new carriageway.

Table 116 **Traffic Flows for Ballynure**

	2016 Do Minimum	2016 Do Something
Bypass Flows	-	17996
Ballynure Flows	16719	3283

Table 117 **Operational Do Something (Opening Year 2016) AADT Figures and Percentage HGVs**

Road Description	2016 Do Something Opening Year			
	AADT NB	AADT SB	% HGV NB	% HGV SB
Ballyearl Road to Ashley Road	9225	10600	10%	11%
Colman's Corner to Lisglass Road	0	0	0%	0%
Lisglass Road to Glen Road	24	24	0%	0%
Glen Road to Rushvale Road	0	0	0%	0%
Rushvale Road to Drumadowney Road	7024	7605	11%	13%
Drumadowney Road to Calhame Road	0	0	0%	0%
Calhame Road to Green Road	0	0	0%	0%
Green Road to Legaloy Road	0	0	0%	0%
A57 roundabout to Main Street	1204	1281	4%	7%
Main Street to Riverside	1184	1281	4%	7%
Riverside to Lismenary Road	997	945	6%	15%
Junction Lane to Ballygowan Road	8823	9740	12%	14%
Ballygowan Road to Moss Lane west	0	0	0%	0%
Moss Lane west to Moss Lane East	0	0	0%	0%
Ballygowan Road to Deerpark Road	9094	9989	12%	13%
Deerpark Road to Park Road	0	0	0%	0%
Park Road to where existing A8 dualled	8834	9731	11%	13%

As a result of the bypass, traffic flow (as detailed in Table 116) through Ballynure is expected to decrease by approximately 80%. Based on the significance criteria detailed in Table 107, this represents a ***substantial*** relief of severance through the village improving access to facilities which are currently severed by the existing A8 road.

By comparing Table 111 and Table 117, sections of the existing highway will experience a significant reduction in overall road traffic including HGVs. The removal of the main carriageway from key service locations could lead to increased local levels of NMU movement within these settlements and their surrounding areas. It is considered that this would have a ***moderately beneficial*** effect within these settlements.

The NMU Context Report (See **Appendix J, ES Volume II**) concluded that very limited numbers of cyclists currently use the existing route. The report also concluded that those cyclists who currently use the route are likely to be commuter cyclists that would prefer to remain using the mainline. Therefore the benefit of the shared footway/cycleway provision is considered to be moderately beneficial and of slight significance.

The importance of pedestrian facilities has been assessed to be of low importance and the magnitude of the impact of the proposed scheme to be a major improvement. Therefore the overall assessment of effects due to operation on pedestrians and cyclists as a result of the A8 Dualling is likely to be ***moderate beneficial*** significance.

15.11.2 Vehicle Travellers

As detailed within chapter 5 ‘The Proposed Scheme’, the proposals for the A8 Dualling would create 14.4km of high speed dual two-lane all purpose carriageway with a national speed limit of 70mph. The scheme would include seven major junctions to link the main A8 carriageway to the main side roads throughout the area. The scheme design has been developed to limit the number of left-in, left-out accesses onto the carriageway as possible. The full scheme design description including the locations of the key junctions are detailed within chapter 5.

15.11.2.1 View from the Road

Vehicle traveller’s currently experience long and wide ranging views along the existing A8 carriageway and across the adjacent landscape. Chapter 9 of this ES considers in detail the impacts of the dualling upon the landscape and visual amenity of the area.

The landscape treatment proposals developed as part of the scheme design have aimed to minimise the visual intrusion of the scheme upon the views across the landscape. These proposals are illustrated within **Appendix D**, **ES Volume II**. It is therefore considered that views from the road would not be adversely affected where areas of high scenic quality and landscape quality have been identified by the landscape assessment.

Views to key features such as the Lowtown Rath SHM would be preserved and landscape treatments are proposed as part of the landscape design which would aim to limit the visual impact of the road upon its setting.

Views across the landscape would be temporarily restricted at the full and compact grade separated junctions detailed within chapter 15.11.2 due to the need to create areas of embankment or cut to carry access roads from the main carriageway to fly-over bridges or under-bridges at each of these locations.

The value of the view from the road is considered to be of low importance given the localised nature of its setting and views towards the Antrim Coast and Glens AONB and the Lowtown Rath SHM. The impact of the A8 Dualling scheme would result in some intermittent views particularly at the locations of the major junctions. Therefore the magnitude of impact of the scheme is considered to be minor. The resulting significance effect has been assessed to be ***negligible***.

15.11.2.2 Driver Stress

The proposals for the A8 Dualling would provide a completed dual carriageway from Belfast to Larne and a road environment which meets the latest design standards for roads in terms of condition and safety.

Drivers would be able to continue travelling onwards from the existing dualled section of the A8 along the proposed scheme to the proposed A36 (Shane's Hill Road) roundabout and beyond at a consistent speed, with a safe overtaking lane available at all times. Pinch points at Ballynure which currently suffer from high traffic volumes at peak periods of congestion would be alleviated due to the bypass of the two main settlements in the area.

The area currently experiences a high volume of HGV traffic daily to and from the Port of Larne. This frequently causes periods of slow moving traffic at peak times, and with few safe overtaking lanes located along the existing route, increases levels of driver stress and frustration. The creation of the new dualling would alleviate this effect due to the presence of two high-speed lanes in both directions. Therefore reducing driver stress and fear of potential accidents and providing a more pleasant travel environment.

Route uncertainty would be reduced due to the implementation of new signage along the new section of the A8, before and at all major junctions advising of new access to key side roads, and at areas of interest such as the Woodland Trust owned Clements Wood. A new lighting strategy would also be implemented at the approach to the major junctions which would also reduce driver stress during night-time journeys.

The A8 Dualling aims to limit the number of access roads and private accesses on to the main carriageway to reduce the risk of potential accidents from emerging traffic and increase the overall safety of the road. As a result a number of accesses onto the carriageway have been stopped-up or diverted onto adjacent side roads where possible and practicable. However, this may result in increased journey lengths and travel time for some local residents along the scheme. As a result these residents may experience a ***slight adverse*** effect due to the impact of the scheme on increased journey times, travel distance, resulting in a rise in driver frustration and stress for those affected. However, this impact is not considered to be significant.

The A8 Belfast to Larne Road is considered to be of high value due to its links to the Port of Larne and identification as a KTC within the RDS and RTS strategic plans. Therefore the overall assessment of effects on vehicle travellers would be ***large beneficial*** for the majority of users given the high importance of the road and the major beneficial effect of the proposals on the road network environment in this area.

15.11.3 Public Transport

The scheme design would see the implementation of a bus stop strategy to serve residents along the A8 as detailed within chapter 15.7.2 to encourage alternative transport methods as recommended by the proposals within RTS and RDS strategic plans.

The number of bus stops is to be rationalised and located in close proximity to the major junctions proposed for the A8 Dualling. This would reduce the number of bus stops along the carriageway to approximately 10, the locations of which are illustrated on **Drawings CSK-1112 and CSK-1113** in **Appendix J, ES Volume II**. The options would provide safer access to and from bus stops, residencies and local services which should make the use of these facilities more attractive to pedestrians.

Services which stop within the settlements of Bruslee and Ballynure would be required to come off the new carriageway to access either settlement.

Bus services for Bruslee would be required to use the existing bus stops, south of Coleman's Corner. The existing bus stop on the existing A8, would be removed as part of the scheme.

Bus services serving Ballynure would access the settlement as follows:

- Northbound services would exit the new carriageway via the A57 Templepatrick Road junction. This junction will connect this redundant section of the existing A8 which would serve as a local road within Ballynure. Services would rejoin the new carriageway via the Ballybracken Road junction; and
- Southbound services would exit the new carriageway at the Ballybracken Road junction and may choose to continue through the settlement and rejoin the new carriageway through the A57 Templepatrick Road junction.

For services which use the A8 but do not stop along the road (see Table 112, chapter 15.6.7), passengers should benefit from less delays caused by existing road conditions, periods of congestion and peak travel times.

Given the rural nature of the area, it is unlikely that the usage of public transport services would increase significantly above existing levels due to the distances between facilities. The main benefit of this element of the scheme is the increased level of safety for users which may benefit school bus services in particular and fewer delays caused by existing road conditions and periods of congestion.

The significance effect of the operation of the A8 Dualling on public transport would be ***slight beneficial*** given that the value of public transport would be low given the rural nature of the area and the magnitude of impact due to operation would be minor.

15.12 Mitigation of Effects due to Operation

No significant adverse impacts have been identified relating to the operation of the A8 Dualling on vehicle travellers as part of this assessment. Therefore no mitigation is required.

15.13 Residual Effects due to Operation

There are considered to be no residual effects due to the operation of the A8 Dualling.

15.14 Cumulative Effects

The cumulative effects are judged to be the same as the operational effects.

16 Community and Private Assets

16.1 Introduction

This chapter presents an assessment of the effects on Community and Private Assets as a result of upgrading a 14km stretch of the A8 Belfast to Larne Road from Coleman's Corner to the B100 (Ballyrickard Road), from single carriageway to dual carriageway standard.

The methodology for the assessment follows the guidance set out in DMRB Volume 11, Section 3, Part 8 '*Pedestrians, Cyclists, Equestrians and Community Effects*', for the assessment of effects on the Community, and Part 6 *'Land Use'* for the assessment of effects on Private Assets. This change in chapter structure and title from the assessment headings of DMRB Volume 11 (Section 3) is in accordance with the updated DMRB guidance for the structure of Environmental Assessments as outlined in DMRB Volume 11, Section 1, Part 1.

16.2 Scoping and Consultation

16.2.1 Scoping

An ES Scoping Report was issued in March 2010 to key statutory and non-statutory bodies outlining the approach, methodology, baseline conditions and expected effects of the scheme.

It was circulated to all stakeholders, offering them an opportunity to address the proposed methodologies for the EIA or to address issues that have not been adequately covered. A list of consultees is included in chapter 7.3.

A response was received from the Countryside Management Department of the Department for Agriculture and Rural Development (DARD). Key elements of the response which are of relevance to this assessment are detailed below:

'*Landowners, including those where the access tracks or working areas are required, must be consulted with regard to their participation in agri-environment schemes. If any of the landowners, or leases, hold management agreements under such schemes they must notify DARD prior to any developments on the land.*'

16.2.2 Consultation

Consultation has been undertaken with the statutory bodies including DARD as part of the ELG meetings as detailed within Chapter 7 'Scoping'. A summary of the key issues of DARD and other statutory bodies is detailed within Table 14.

16.3 Methodology for Assessment of Effects due to Construction and Operation

The overall approach for the assessment of community and private assets is to examine the existing land use pattern, assess the areas of land lost and the resultant effect on land use and the community. This was completed by a desk based study and a number of site visits throughout 2009 and 2010 to establish the existing community provision and land use pattern.

16.3.1 Scheme Assessment Area

Community

DMRB Volume 11, Section 3, Part 8[110] does not specify a scheme assessment area to use when considering the effects on communities and community facilities. Therefore due to the rural nature of the locality of the A8, key settlements along the A8 have been examined together with references made to the nearest available sources of the facilities outlined above if not available locally.

Private Assets

DMRB Volume 11, Section 3, Part 6 'Land Use' does not specify a scheme assessment area to use when considering the effects on private assets[111] as a result of the construction and operation of the scheme. Therefore the assessment has considered all those persons and properties which have the potential to be affected by the scheme and who have been contacted as part of the one-to-one consultation process undertaken by the Arup.

16.3.2 Community

The assessment of potential effects during construction and operation on Community is drawn from the methodology described under DMRB Volume 11, Section 3, Part 8, relating to '*Pedestrians, Cyclists Equestrians and Community Effects*'. The assessment focuses on the change in duration and distance of journeys made by local people to access community facilities as a result of the scheme proposals. DMRB Volume 11, Section 3, Part 6 '*Land Use*' examines the effects upon the community resource in terms of the loss of community land due to the proposals.

The assessment methodology is based on a qualitative assessment of potential changes in journey length and travel patterns to community facilities. For the purpose of the assessment, key community facilities are defined based on the DMRB guidance, as follows:

- Doctors;
- Hospitals;
- Aged persons homes;
- Schools;
- Shops;
- Post Offices;
- Churches; and

[110] DMRB Volume 11, Section 3, Part 8 'Pedestrians, Cyclists, Equestrians and Community Effects'
[111] 'Private assets' refer to any private property, community land, development land, agricultural land and commercial land within the scheme assessment area.

- Parks, play areas, sports centres etc.

Information on community facilities was established through a desk based search of online resources and site visits to identify the main facilities serving the scheme assessment area.

16.3.3 Private Assets

DMRB Vol.11 Section 3 Part 6 states that the assessment for Land Use should be sufficient *"to identify the type and number of properties which might need to be demolished*". This includes residential, commercial, industrial and agricultural.

The overall approach is to examine the existing land use pattern, assess the areas of land lost and the resultant effect on land use.

The main effects examined by the assessment are as follows:

- Demolition of private property and associated land take;
- Loss of land used by the community;
- Loss of development land;
- Loss of agricultural land and assessment of severance; and
- Treatment of the unused sections of the existing highway.

Community land is defined by DMRB as land used by the community and includes common land, town and village greens and general public open spaces.

Development land is defined by DMRB as land identified within local and structure plans that has been allocated for potential future development. The development may be housing or industry or business based. Information concerning valid planning permissions and development land allocations within the adopted local planning documents the surrounding areas was sought and collated from the Planning Service.

Private property looks at the demolition of private properties but also examines the effects on business/commercial properties. Landowners who could be affected by the scheme were consulted by the Roads Service regarding any concerns or queries they may have had on the scheme proposals. Comments were recorded and incorporated into the preliminary design wherever possible to minimise the effects upon properties, land and access arrangements.

The Agricultural Land Classification (ALC) system was published by the then Ministry of Agriculture and Fisheries and Food (MAFF) UK (now the Department for Environment, Food and Rural Affairs (Defra)). The system classified agricultural land in England and Wales by grade according to the extent to which its physical or chemical characteristics impose long term limitations on agricultural use for the production of food. While this system is not formally adopted in Northern Ireland, maps are available from DARD displaying agricultural land grades. The best and most versatile land is defined as Grades 1 to 3a.

Table 118 outlines the grades within the ALC system.

Table 118 **ALC System Grades and Classifications**

Agricultural Grade	Classification of Grade
Grade 1	Excellent
Grade 2	Very Good
Grade 3a	Good
Grade 3b	Moderate
Grade 4	Poor
Grade 5	Very Poor

Agricultural Impact Assessments (AIAs) have been undertaken for a number of landowners within the scheme assessment area. The assessments were undertaken by an Agricultural Specialist (McIlmoyle & Associates) to determine the nature of agricultural land use and the effect of the proposed scheme on the viability of the land and the farm as a business. The results of this assessment have been used to inform the overall Community and Private Assets assessment.

16.3.4 Significance Criteria

Tables 6.2 to 6.5 within Chapter 6 '*Approach and Methods*', of this ES detail the criteria which have been used to determine the significance of effects for the assessment of effects on Private Assets and Community. These significance criteria have been derived from DMRB Volume 11, Section 2, Part 5 (HA 205/08) guidance for the '*Assessment and Management of Environmental Effects*'.

The significance criteria used to assess the effect upon agricultural land has been taken from the AIAs. A description of the significance criteria used within the AIAs is detailed in Table 119.

Table 119 **Agricultural Impact Assessment Ratings**

Agricultural Impact Rating	Description of Impact
Slight Adverse	Little or no agricultural impact to the landowner, as the land is rented out in conacre, to be farmed by another landowner; An inconsequential land take or minimal loss of agricultural production, relative to the overall scale of the holding and farm business (with no scheme); Insignificant disruption to the present farm management routine; Insignificant impact on the present farm profitability (based on a subjective assessment); Little or no impact, since land not currently used for agricultural production purposes; or Little or no impact on overall farm viability.
Moderate Adverse	A small to moderate land take, relative to the overall scale of the holding and farm business (with no scheme); Small to moderate disruption to the present farm management routine; Small to moderate impact on the present farm profitability, arising from additional costs associated with farming retained lands (based on a subjective assessment); or Moderate impact on overall farm viability.
Significant	A sizeable area of the farm being removed from agricultural production,

Agricultural Impact Rating	Description of Impact
Adverse	relative to the present area being farmed (with no scheme); Substantial disruption of the present day to day management routine, compared with present practices (with no scheme); Significant impact on the present farm profitability, arising from additional costs associated with farming retained lands (based on a subjective assessment); or Significant impact on overall farm viability.

16.4 Limitations and Assumptions

16.4.1 Limitations

16.4.1.1 Community

The assessment is limited to the identified community facilities. It is possible that other community facilities exist which have not been identified and thus have not been included in this assessment. Every effort has been made to identify as many facilities as possible and any unidentified facilities are likely to be few in number and unlikely to be used heavily by the community.

The assessment has been informed by site visits throughout the scheme assessment process and desk study research of the community facilities within the area.

It was not possible to map catchment areas as part of the assessment given the rural nature of the scheme and the influence of the existing A8 as a key transport route.

16.4.1.2 Private Assets

The location of potential construction site compounds has been identified. This assessment has considered the use of the full area of land which has been identified by the land vesting process. These areas are identified within **Drawing A8-S3-3001 to 3010, Appendix B, ES Volume II**.

16.4.2 Assumptions

In order to assess the effects upon local communities, the assumption has been made that the existing community facilities would continue in their current locations and in their use at present to 2016. This has been assumed as it is not possible to predict changes in the availability of individual facilities or the arrival of new facilities. Existing community facilities are shown on **Drawing A8-S2-3800 to 3802, Appendix K, ES Volume II.**

The assessment of effects on agricultural land is based upon the impacts reported within the AIAs undertaken for landowners considered by the project team and McIlmoyle & Associates to potentially have the most significant agricultural impacts.

16.5 Baseline Conditions

The following baseline conditions have been identified through a desk study and site visits.

16.5.1 Community

The main settlements within the scheme assessment area are settlements of Bruslee to the south and Ballynure in the middle of the scheme assessment area. Ballynure and Bruslee are designated as a village and a small settlement respectively within the settlement hierarchy of the BMAP.

Supporting these small settlements are the main towns of Newtownabbey, south of the scheme assessment area, Ballyclare to the west, and Larne to the north. Newtownabbey and Larne are designated as towns within the BMAP and Larne Area Plan respectively. Ballyclare is designated as a small town. These settlements are located in excess of 1km away from the A8 and are not directly affected by the scheme. However, they provide a wide range of facilities and services including local and larger shops and supermarkets, health facilities, schools, churches, restaurants and public houses.

The human population of the scheme assessment area is relatively small and shared between the settlements of Ballyclare, Ballynure and Bruslee and the rural countryside. Census data for 2001, provided by the Northern Ireland Statistics and Research Agency (NISRA) identifies the settlement of Ballynure with a permanent population of 677. There are no statistics for Bruslee. Surrounding settlements and their populations are detailed in Table 120.

Table 120 **Population Statistics for Surrounding Settlements**

Settlement Name	Population
Ballyclare	8770
Ballyeaston	90
Ballynure	677
Bruslee	No data available
Larne	18228
Straid	312

The closest known doctor’s practices to the assessment are the Ballyclare Group Practice (known locally as the Ballyclare Health Centre) serving the south of the scheme assessment area and the Larne Health Centre serving the north of the scheme.

The Ballyclare Health Centre has over 14,500 patients, eight doctors, two practice nurses and 20 administrative and clerical staff. The health centre is approximately 4.2km from Coleman’s Corner the southern end of the scheme.

The Larne Health Centre is located in 4.8km north of the B100 (Ballybracken Road) Junction at the northern end of the scheme.

There are no aged person’s homes within the scheme assessment area. The closest facilities are located in Newtownabbey and Larne. Clonmore House Residential Home is approximately 8.5km from the southern end of the scheme (Coleman’s

Corner). Colebrooke Residential Home is located approximately 8.0km from the northern end of the scheme (B100 Ballyrickard Road Junction).

One school is located within the scheme assessment area. Ballynure Primary is located on Church Road, Ballynure and is approximately 5.8km and 8.4km from the southern and northern ends of the scheme respectively. Other junior and senior schools are located in the larger settlements of Ballyclare, Newtownabbey and Larne.

There are two petrol filling stations within the scheme assessment area, one within the settlement of Ballynure, and one just north of the B100 (Ballyrickard Road) junction.

The following additional facilities and services are also located within Ballynure village:

- Ballynure Petrol Filling Station and Centra small supermarket;
- Beaties Fish and Chip shop;
- Co-operative supermarket;
- Post Office;
- Jackson’s Butchers; and
- Other various retail outlets and Public Houses.

A small industrial park is also located on the outskirts of the village on the Church Road. The area contains a small number of light industrial, commercial and service sector industries including:

- Neville Graham Engineering;
- Ballynure Radiator Services; and
- Irelands – Advanced Conveyor Components.

There are three churches within Ballynure a number of which have associated community halls from which local community groups run organisations and local events:

- Christchurch (Church of Ireland) and Church Hall;
- Ballynure Methodist Church and Church Hall; and
- Ballynure Presbyterian Church and associated church hall which includes the following facilities: multi-purpose halls, crèche and mums and toddler area, youth hall, sports hall, and kitchens.

The smaller settlement of Bruslee is located at the southern end of the scheme and provides the following services:

- Bruslee Recycling centre;
- East Antrim Metals and Fabrication;
- C2K North Eastern Centre (Study Centre for schools);
- Brethren Church Hall; and
- Logwood Plant and Garden Centre (including Snob Logs coffee shop).

There are a number of designated open spaces within the study area. The majority are located within the settlement of Ballynure with the exception of the Woodland Trust's Clements Wood (in the northern section of the scheme assessment area). They include:

- Ballynure Village Park;
- Ballynure Children's Play area;
- Lismenary Road grassed area;
- Castletown Park; and
- Clements Wood.

Ballynure Village Park (also known as War Memorial Park) and children's play area account for 0.54 hectares of open space within the village, affording opportunities for physical activity for residents of the village and those in the surrounding area. Castletown Park and Lismenary Road are both owned by the Northern Ireland Housing Executive (NIHE) and account for 0.25 hectares of open space within the village. Clements Wood is accessed via the Ballygowan Road, with a maintenance access directly onto the A8. The wood has areas of open space, wet meadows as well as woodland. There are a number of walks through the wood affording opportunities for activity and amenity. The area is predominantly rural with limited local community facilities outside the settlement of Ballynure. Many facilities are likely to be accessed by car in the larger settlements of Larne, Ballyclare and Newtownabbey.

Drawing A8-S3-3800 to 3802, Appendix K, ES Volume II shows the location of the community facilities detailed above.

16.5.2 Private Assets

16.5.2.1 Non-Agricultural Land

Urban influences infiltrate the scheme assessment area around the settlement of Ballynure which comprises a small selection of retail and commercial outlets. Facilities within the village are currently severed by the existing A8 carriageway which runs through the village.

The scheme assessment area is situated between a number of urban centres and is the main route between the Port of Larne and the Northern Ireland capital city, Belfast. Pockets of industrial and other non-agricultural land use can be found along the route, such as the FP McCann Loughside Quarry in the north of the scheme assessment area.

16.5.2.2 Community Land

DMRB Volume 11, Section 3, Part 6 defines 'Community Land' as *land which is used by the public for recreation or which may have conservation landscape or other heritage value*. These areas include town/village greens, garden allotments and public open spaces.

There are a number of areas of public open space within the scheme assessment area which are used by the community. These include Ballynure Village Park also known as War Memorial Park and Clements Wood.

Ballynure Village Park consists of 0.54ha of open space including a children's playground. This park is designated as open space within the *BMAP 2015* and is protected by *PPS 8 Open Space, Sport and Outdoor Recreation*.

Clements Wood is managed by the Woodland Trust and located in the northern end of the scheme assessment area (See **Drawing A8-S3-3802, Appendix K, ES Volume II**). The wood consists of 3.5ha of land with walking trails through planting and wet meadows.

There are known archaeological remains within the scheme assessment area, including several raths and the Lowtown Rath which is a SHM located at the northern end of the scheme. For more details on this and other historic features of the area please see chapter 10 'Cultural Heritage'.

16.5.2.3 Committed Development

Consultation has been undertaken with Planning Service to establish known committed development and current planning applications within the scheme assessment area and periphery which may have an impact on the scheme.

Table 1 and 2 within **Appendix K, ES Volume II** details the planning applications[112] which were under consideration or which had received permission and were deemed relevant. It is unknown whether these developments have been undertaken. Therefore this list of applications is a representation of what could be present. As planning permission in Northern Ireland lasts for five years, a baseline for establishing relevant developments was set by selecting those which have been granted permission in or after 2003.

16.5.2.4 Development Land

According to DMRB Volume 11, Section 3 Part 6, Development land is defined as '*land identified in the local and structure plans that have been allocation for potential future development. The development may be housing, industry or business based*'.

In terms of development land within the scheme assessment area, there are no areas of land designated for housing, industry or employment. However, the following areas have been identified within the Larne Area Plan which may be of relevance to the scheme assessment. No areas designated within the BMAP were considered to be significant to the scheme.

- Lands at Drumahoe – Land to the north of the A8 junction with the Shane's Hill Road has been zoned within the Larne Area Plan for future industrial development to promote investment in the area. In total 31.7 ha has been designated in this location; and
- Lands at Ballyloran – Land to the north of the A8 junction with the Shane's Hill Road has been zoned for future housing within the Larne Area Plan.

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[112] Assessment based upon information received from The Planning Service on 10th January 2010 and planning applications logged by 18th October 2009.

Both areas are shown on **Drawing CSK-1190 of Appendix B of the NMU Context Report, Appendix K, ES Volume II**.

16.5.2.5 Agricultural Land

Agricultural land within the scheme assessment area is dominated by a mix of semi-improved, arable or improved grasslands. Fields are used for grazing dairy and beef cattle, sheep, and for growing some arable crops such as barley, wheat, potatoes and maize.

The majority of the agricultural land from Coleman's Corner roundabout to just south of Ballynure is classified as Grade 3b[113]. From Ballynure to Craiginorne both sides of the A8 are a combination of Grade 2[113] and 3a[113] (Best and Most Versatile land), with the northern section of the scheme assessment area to Larne comprising a mix of Grade 3a[113], 3b[113] and 4[113] as shown on **Drawings A8-S3-3803 to 3805, in Appendix K, ES Volume II**.

The DARD currently facilitates agri-environmental schemes throughout Northern Ireland. The objectives of these schemes are to restore farmland biodiversity, improve the quality of water, air and soil, enhance the landscape, and help mitigate against climate change. There are currently two agri-environment schemes in operation by DARD:

- Northern Ireland Countryside Management Scheme (NICMS); and
- Organic Farming Scheme.

The AIAs undertaken by McIlmoyle & Associates and one-to-one consultation meetings with the Arup design team have identified those landowners which currently partake in agri-environment schemes. Of those who have had an AIA undertaken, seven landowners currently have land registered under the NICMS. The reports did not indicate if any farms currently took part in the organic farming scheme. Table 3 within **Appendix K, ES Volume II** also identifies additional landowners who have stated within one-to-one meetings that they currently participate in the NICMS.

16.6 Environmental Design

As detailed within chapter 5.3.1, the A8 Dualling scheme has progressed with continuous collaboration between the design team and environmental specialists. Through this process, an environmental design has been developed as an integral part of the overall scheme design. These measures have been assessed as part of the scheme and are not considered to be additional mitigation measures.

The scheme design has been developed and progressed to have the least impact upon the environment, private property and land use. There is no specific environmental design measures relating to this assessment included in the scheme design. However, discussions between landowners and the design team have sought to accommodate and refine the scheme design to minimise impacts where possible and practicable.

[113] Refer to

Table 118 for description of agricultural grades.

16.7 Assessment of Effects due to Construction

16.7.1 Community

The majority of community facilities serving the population of the scheme assessment area are located within the two small settlements of Bruslee and Ballynure, with larger more specialised facilities available at larger towns nearby (see chapter 16.5.1).

The alignment of the dualling includes a bypass of both settlements and as a result would not experience any direct effects as a result of the construction works. However, they may experience indirect adverse effects including increased levels of through traffic including a higher percentage of HGV and other construction vehicles throughout the construction phase. The magnitude of this impact could be neutral to minor adverse.

A significant number of local commercial and community facilities are located within the settlement of Ballynure. It is considered that as the majority of these facilities are located away from the main highway and that the settlement is to be bypassed, these facilities would not be expected to experience direct adverse effects due to the construction works. However, indirect effects may include delays in travel time and increases in journey lengths for delivery vehicles and customers where there may be diversions or road works in the vicinity of Ballynure. The magnitude of this impact could be neutral to minor adverse.

The presence of a construction workforce within the area for a period of approximately two years could however provide an additional customer base for local shops and services and create potential new jobs. The magnitude of this impact is difficult to predict but could be neutral to minor beneficial.

The NMU survey identified desire lines of pedestrian activity between the community facilities located within Bruslee and Ballynure which are currently situated on either side of the existing A8 (see chapter 15.6.5). Therefore these journeys to community facilities by pedestrians may be made less attractive by the increased levels of road traffic during the construction phase.

A number of commercial and light industrial businesses and services are located on the Church Road, Ballynure (See **Drawing A8-S3-3800, Appendix K, ES Volume II**). Access to and from these businesses is currently provided via the existing A8 as it passes through the settlement of Ballynure. The scheme design includes the stopping-up of Church Road to the east of the Ballynure bypass, and a new road from the west of the bypass linking Church Road to the A57 Templepatrick Road junction (see **Drawing A8-S3-0004, Appendix B, ES Volume II**).

The construction of the bypass and link road would require significant construction activity within the vicinity of Church Road. During this time access to the businesses detailed in chapter 16.5.1 may be adversely affected. Access along Church Road to and from Ballynure would remain until the new link road and A57 junction are constructed, at which point, traffic or persons wishing to access Ballynure or the facilities on Church Road would be required to undertake a substantial diversion. Further details on the impacts for travellers is described in chapter 15 ‘Effect on All Travellers’.

The detailed construction methodology at this location is not known at this time. However, it is assumed that the works may involve significant traffic management or road closure at times to facilitate elements of the works. This may require temporary road diversions via the Lismenary and Lower Ballyboley Roads.

Additional impacts on these businesses during construction could include delays in travel time and increases in journey length where there may be diversions or road works in operation within their vicinity. This may result in additional operational impacts for these businesses such as customer disruption and delivery delays due to the works. The magnitude of this impact is difficult to predict but could be neutral to minor adverse.

Clements Wood would experience a direct impact due to the construction of the scheme. The small woodland park would require the permanent land-take of approximately 3000m² or 0.3ha. This would take the form of an almost rectangular strip running the full length of the boundary adjacent to the existing A8, approx 91m in length and 33m in width.

During the construction phase, accommodation works within the Clements Wood would be required for the site. This includes the upgrade of an internal river crossing to provide access within the site for maintenance vehicles. During this time, pedestrian access to the wood may be restricted or unavailable. The length of time required to complete the works is not known; however, it is expected that this would be a short term impact.

Vehicle access to the wood would be directly affected during the construction works within the vicinity. Once construction in this area begins, access may be restricted at various times at both the Ballygowan Road and the Moss Road.

The impact on the operation of the wood as a community facility is expected to be slight adverse during the construction phase. This is due to the low value of the resource and the minor adverse magnitude of impact due to the land-take and loss of direct access, resulting in a slight adverse effect.

No other community facilities would be directly affected by the construction of the scheme.

The overall effect upon community facilities during the construction phase is considered to be ***slight adverse***. This is based on a low value of the resource and a slight to moderate adverse impact upon the resource as a result of the construction phase. Given the existing condition and the existing levels of severance within the main settlements of Bruslee and Ballynure as a result of the existing A8, the significance of the additional effects are considered to be ***minor***.

16.7.2 Private Assets

The assessment of effects on private assets/land use considers the following:

- Demolition of property and associated land-take;
- Loss of land used by the community;
- Effect on development land; and
- Effects on agricultural land.

16.7.2.1 Demolition of Private Property and Associated Land-take

Table 3, **Appendix K, ES Volume II** details the residential properties impacted upon by the A8 Dualling. For confidentiality reasons, the names of individual landowners and property address details have been omitted from this report and are referred to by an assigned numerical reference.

There are a number of residential properties within the assessment area with direct access either from the A8 or the associated side roads. In total, 111 residential properties would be affected by the scheme either through loss of a building, land-take from the residential plot of the property or a change in access arrangement from their existing situation. In total, five residential properties would be demolished. Of these properties two are currently owned by the Roads Service, one is derelict, one was under construction (foundation level), and one is in private ownership.

Table 121 **Land-take Required for Construction of A8 Dualling**

Type of Land	**Approximate Land-Take Area (ha)**
Commercial/Industrial Land-take	2.3
Residential Land-take	3.8
Agricultural Land-take	130.0
Community Land-take	0.3
Road Bed	38.3
Total Land-take	174.7

The land-take figures in Table 121 are representative of the land-take required for the footprint of the carriageway, maintenance areas, land to facilitate the accommodation works and elements of the wider scheme design as detailed within chapter 5 '*The Proposed Scheme*'.

The effect on private property due to the construction of the A8 Dualling would be ***moderate adverse*** due to the loss of property and land-take from affected residents.

16.7.2.2 Commercial Property

Commercial facilities are identified on **Drawings A8-S3-3800 to 3802, Appendix K, ES Volume II**. Commercial property directly impacted by the scheme includes:

- Bryan Orr Developments;
- The Roads Service Maintenance Depot; and
- FP McCann Loughside Quarry.

Table 122 details the land-take required from commercial property within the scheme assessment area.

Table 122 **Effects of the A8 Dualling on Commercial Property and Land**

Commericial Property Affected	**Description of Effects**	**Effect**	**Land-take (Ha)**
Bryan Orr Developments	• Land-take • New Access arrangements • Diversions required	Slight Adverse	0.07
The Roads Service Maintenance Depot	• Loss of one building • Land-take	Slight Adverse	0.26
FP McCann Loughside Quarry	• Loss of up to 3 buildings • Land-take • New Access arrangements with Deerpark Road Junction	Slight Adverse	2.00

Land-take would be required from Brian Orr Developments which is located close to the settlement of Ballynure. A small area of land-take and a new access arrangement would be required to facilitate the construction of the road. During construction there may be short term disruption to this business during the works in the vicinity of the property which may cause access and egress delays or diversions. However, these effects are not considered to be significant. The land-take from the property is also not considered to be significant in terms of the future of the business at this site, therefore the effect has been assessed to be ***slight adverse*** due to the low value of the resource and the minor impact upon the business.

The Roads Service Maintenance Depot located in the northern end of the scheme, would lose approximately 0.26 ha of land which includes one building within the site. As the site is owned by the DRD, the effect of the loss is not considered significant in terms of future operations at this site. Effects which may be experienced during the construction phase include access and egress onto the carriageway, traffic management and travel delays. The effect has therefore been assessed as ***slight adverse*** due to the low value of the buildings and moderate impact of the loss.

The Loughside Quarry is located within the northern section of the scheme (see **Drawing A8-S3-3802, Appendix K, ES Volume II**). The proposed scheme would require a significant area of land-take from the quarry site to accommodate the new Deerpark Road junction, a potential site compound and the realignment of the Larne River within the quarry grounds. As detailed in Table 122, approximately 2ha would be lost through land-take from the quarry for the construction of the scheme. Approximately three properties would also be lost based on the current scheme design and vesting proposals, however there usage is not considered to be essential for the operation of the business. Therefore due to the low value of the buildings and moderate impact of the loss of the buildings and land, the overall significance of the construction effects on the quarry is ***slight adverse***.

The existing access to the quarry would be lost due to the scheme with a new access incorporated into the Deerpark Road junction. The existing access would be maintained while the new junction is constructed, however, access may be affected by the works which may have ***slight adverse*** impacts for daily commercial vehicles to and from the site in terms of access and egress during periods of traffic management.

As detailed in chapter 16.7.1, a number of other commercial properties would experience indirect effects as a result of the construction phase of the scheme such as traffic management and travel delays etc.

The significance of this effect upon commercial properties during construction would be ***slight adverse*** and of slight significance**.**

16.7.2.3 Construction Site Compounds

As detailed within chapter 16.4.1.2, the assessment of the effects of construction site compounds has considered the use of all areas identified by the contractor as illustrated within **Drawings A8-S3-3001 to 3010, Appendix B, ES Volume II**.

Site compounds are temporary, however, it is likely that they would be in use for a considerable period of time, utilising most likely agricultural land, which would not be available for use during this time. Therefore the significance effect of construction site compounds would be ***moderate adverse*** given the moderate adverse magnitude of the effect of the land-take required.

16.7.2.4 Loss of Land Used by the Community

As detailed within chapter 16.7.1 Clements Wood would be directly impacted upon by the scheme and would lose approximately 0.3ha in land-take from its boundary with the existing A8 carriageway. Additional effects experienced by this community facility are also detailed above in chapter 16.7.1.

The significance effect on Clements wood is expected to be ***slight adverse*** during the construction phase. This is due to the low value of the resource, as it is a small, young woodland, and the minor adverse magnitude of impact due to the land-take and loss of direct access. The viability of the site as an amenity or community facility is not affected by the loss of land.

16.7.2.5 Effects on Development Land

The designated areas for development identified within chapter 16.5.2.4 would not be affected by the construction of the A8 Dualling as they currently lie outside the scheme assessment area.

16.7.2.6 Effects on Agricultural Land

The proposed scheme would run through agricultural land of varying quality, ranging from top quality, free-draining arable land to poor quality, heavy land, which is readily waterlogged, supporting only rough grazing or scrub land. The construction of the scheme would impact upon mixed farming, agricultural land, that is mainly in grassland and utilised for livestock production (dairy, beef, and sheep), with some areas also utilised for crop production.

Drawings A8-S3-3803 to 3805, Appendix K, ES Volume II illustrates that the alignment of the proposed scheme impacts upon best and most versatile land (Grade 2 and 3a) most significantly where the scheme by-passes the settlement of Ballynure. However, this is not considered to be a significant loss and would have a ***negligible*** effect in terms of the overall agricultural output of Northern Ireland.

The agriculture assessment has been informed by the findings and reports of individual AIAs undertaken by agricultural consultants McIlmoyle & Associates. They have reported that the proposed scheme would impact on generally good quality agricultural land as it closely follows the existing corridor. The AIAs undertaken to date are identified within Table 3, **Appendix K, ES Volume II**. For confidentiality reasons the names of properties and individual landowners detailed in Table 3 have been omitted from this report and are referred to by an assigned numerical reference.

In total 43 farm businesses would experience an adverse impact on their management, performance and future viability with 36 ***slight adverse*** impacts, three ***moderate adverse*** impacts and four ***significant adverse*** impacts. Four farm businesses would experience a ***negligible*** impact. However, the scheme would not have a significant impact on the Northern Ireland agricultural industry as a whole.

Agri-environment Schemes

As detailed in chapter 16.5.2.5, seven of the farms who had AIAs undertaken currently participate in the NICMS. The extent of the land within each of the farms which is used as part of the scheme is unknown. However, given that each of the landowners identified would experience land-take due to the construction of the road, it is assumed that there is potential for this to result in a loss of land used for the scheme. Therefore the significance of this effect due to the construction of the scheme on agri-environment schemes could be ***slight to moderate adverse*** due to the medium value of the resource and the minor to moderate impact of the land-take.

16.8 Mitigation of Effects due to Construction

No mitigation measures have been considered necessary for this assessment.

16.9 Residual Effects due to Construction

The residual effects from the scheme are considered to be the same as the construction effects detailed in chapter 16.7 as no mitigation measures have been proposed to reduce or offset the original effects due to construction.

16.10 Assessment of Effects due to Operation

16.10.1 Community

As detailed within chapter 16.5.1, the majority of community facilities are located within the settlements of Bruslee and Ballynure.

The new junction arrangement at the Moss Road and the closure of the direct access from the Ballygowan Road onto the A8 would mean that visitors to Clements Wood would require a diversion from the existing situation. Access would be via the Moss Road junction onto the Ballygowan Road. Providing access through the junctions to side roads aims to reduce the risk of access and egress issues associated with left and right turns onto a carriageway. Provision of a brown tourism sign along the carriageway is under consideration and would benefit the facility by drawing attention to its location.

Visitors would experience increased travel distances and time to access the facility. However, this effect is not considered to be significant as visitors to the site do so for recreation and time would not be a principle factor in the decision to visit the facility.

Therefore the operational effect on this community facility has been assessed as ***neutral*** due to the negligible (very minor beneficial) impact of the improved awareness of the facility within the local area.

Community facilities within Bruslee and Ballynure which currently experience high levels of severance due to the presence of the existing A8 would benefit from the operation of the scheme. As detailed within chapter 15.11.1, traffic flows through Ballynure could be reduced by approximately 90%[114] (see Table 116). As a result, severance within the village would be significantly reduced. This would improve access to facilities within the settlement, and together with the provision of pedestrian and cyclist facilities linking the existing within Ballynure, usage may increase.

The overall significance effect of the operation of the scheme on community is considered to be ***moderate beneficial*** due to the major beneficial magnitude of impact of removing a highway environment from the key settlements and the reduction in severance allowing greater freedom and movement across the settlements to access key community facilities including education and retail.

16.10.2 Private Assets

16.10.2.1 Demolition of Private Property and Associated Land-take

No effects have been identified in terms of demolition of private property and associated land-take due to operation. All effects are considered to be experienced during the construction phase. See chapter 16.7.2.1.

16.10.2.2 Commercial Property

As identified in chapter 16.7.2.2, the main commercial properties within the scheme assessment area are located within the settlements of Bruslee and Ballynure. As these settlements would be bypassed by the proposed scheme, they could experience advantages and disadvantages from the removal of through traffic within their immediate vicinity.

Benefits would include access to a complete high-speed dual carriageway northbound and southbound between the Port of Larne and Belfast. This could create the potential for better access and connectivity with commercial markets in the region and the UK. The magnitude of these benefits are difficult to quantify

[114] See Table 2, Chapter 15 Effect on All Travellers.

however, as the dualling scheme is highlighted as a strategic driver for the economy in this area, it is expected that better transport links would encourage economic activity for commercial resources as a result of the operation of the scheme.

It is possible however, that retailers within the settlements of Bruslee and Ballynure could perceive the loss of through traffic as an adverse impact on local commerce as less through traffic could result in a decline in customer numbers.

The effect on commercial property and land due to operation is deemed to be ***slight beneficial to slight adverse*** due to the potential moderate beneficial impact of improved transport links throughout the region but also due to the potential for local retailers to perceive the loss in through traffic as an adverse impact on local business and commerce within these settlements.

16.10.2.3 Loss of Land Used by the Community

As identified within chapter 16.7.2.4, a small area within the Clements Wood would be lost due to construction. No land would be lost due to the operation of the scheme and the viability of the resource would not be significantly affected. Therefore the effect due to operation on community land is ***negligible***.

16.10.2.4 Effect on Development Land

Overall the scheme proposals would provide an enhanced road environment, shorter journey times, better access arrangements and links to settlements from the A8 northbound and southbound, as well as better pedestrian facilities for designated development sites identified within chapter 16.5.2.4. The completion and operation of the scheme would fulfil the objectives for the dualling within local and strategic development plans and would complete the dualling of the Eastern Seaboard Key Transport Corridor.

The value of the local development land resource has been assessed to be low due to the local nature of the plans. The magnitude of impact due to the scheme has been assessed to be moderate beneficial due to the beneficial impact of improved access and connectivity to the Port of Larne, Belfast and rest of Northern Ireland.

Therefore the significance effect on development land due to operation would be ***slight beneficial***.

16.10.2.5 Effects on Agricultural Land

As detailed in chapter 16.7.2.6 the findings of the AIAs indicate that the proposed scheme would impact on generally good quality agricultural land as it closely follows the existing corridor. As well as the impacts identified during construction, effects due to operation include increased severance for some farmers with fields on opposite sides of the carriageway. Journey length and times could be increased as access to the adjacent carriageway would only be accessible via the proposed all movement junctions for most landowners. Where possible these effects have been offset through the scheme design and measures agreed with affected farm and landowners.

The scheme design includes the construction of an agricultural overbridge at Ch6+900, to serve three farms that have been assessed to be significantly affected by land severance.

The effect on agricultural land due to the operation of the A8 Dualling would be ***moderate adverse*** due to the moderate adverse impacts of severance, additional journey lengths, diversions and new access arrangements which would be experienced by affected landowners detailed within **Appendix K, ES Volume II**.

16.11 Mitigation of Effects due to Operation

16.11.1 Community

No adverse effects have been identified due to the operation of the scheme. It is considered that any measures required to reduce the effects of the scheme have been incorporated into the scheme design.

16.11.2 Private Assets

The scheme design includes the construction of an agricultural overbridge at Ch6+900 to serve three farms that have been assessed to be significantly affected by land severance.

16.12 Residual Effects due to Operation

It has been assumed since that appropriate mitigation measures where necessary have been incorporated into the A8 scheme design. Any additional measures are considered to have a negligible influence over the operational effects identified.

It is considered that the presence and operation of the A8 Dualling would create land severance (agricultural land) for some affected landowners and would increase journey times. As this could not be mitigated any further it is considered a residual effect of the scheme. The overall effect would therefore remain as ***moderate adverse*** due to the moderate adverse magnitude of this effect.

There are not judged to be any other significant residual effects arising from the operation of the scheme.

16.13 Cumulative Effects

The cumulative effects are judged to be the same as the operational effects.

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17 Policies and Plans

17.1 Introduction

This chapter provides an overview of the relevant statutory context, including descriptions of key strategic planning policies and guidance that have been considered throughout the development of this scheme. The policy provisions of relevant European and UK (Northern Ireland) legislation and planning guidance have been identified and described accordingly.

In addition, guidance was sought through the Environmental Liaison Group (ELG) meetings on impending legislation which may have a material bearing on policies for land use and transport. Guidance on the implications of plans and policies is provided in DMRB Volume 11, Section 3, Part 12, Impact of Road Schemes on Policies and Plans.

The following legislation and policies were considered when undertaking this assessment:

- European Council Directives:
  - EIA Directive 85/337/EEC as amended by Directive 97/11/EC and Directive No. 2003/35/EC;
  - Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (**the Habitats Directive)** including the Article 6 (Managing and protecting Natura 2000 sites) Appropriate Assessment;
  - **Directive 2009/147/EC** – on the conservation of wild birds (the codified version of Council Directive 79/409/EEC as amended) (the **Birds Directive**);
  - Directive 2000/60/EC establishing a framework for the Community action in the field of water policy; (the Water Framework Directive);
  - The Public Participation Directive (2003/35/EC); and
  - Directive 2002/49/EC relating to the assessment and management of environmental noise (the Environmental Noise Directive).
- Northern Ireland Legislation:
  - The Roads Order (Northern Ireland) 1993;
  - The Roads (Environmental Impact Assessment) Regulations (Northern Ireland) 1999;
  - The Water (Northern Ireland) Order 1999;
  - The Drainage (Northern Ireland) Order 1973 (as amended);
  - The Groundwater Regulations (Northern Ireland) 2009 (as amended);
  - The Pollution Prevention and Control Regulations (Northern Ireland) 2003;
  - The Water Abstraction and Impoundment (Licensing) Regulations (Northern Ireland) 2006;
  - Environmental Liability (Prevention and Remediation) Regulations (Northern Ireland) 2009;

  - The Nature Conservation and Amenity Lands (Northern Ireland) Order 1985 (as amended);
  - The Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 (as amended);
  - The Wildlife (Northern Ireland) Order 1985 (as amended);
  - The Environmental Impact Assessment (Uncultivated Land and Semi-Natural Areas) Regulations (Northern Ireland) 2006;
  - The Environment (Northern Ireland) Order 2002;
  - The Fisheries Act (Northern Ireland) 1966 (as amended);
  - The Historic Monuments and Archaeological Objects (Northern Ireland) Order 1995;
  - The Public Health (Ireland) Act 1878;
  - The Clean Air (Northern Ireland) Order 1981;
  - Air Quality Regulations (Northern Ireland) 2003;
  - The Air Quality Standards Regulations (Northern Ireland) 2010;
  - The Noise Insulation Regulations (Northern Ireland) 1995;
  - The Environmental Noise Regulations (Northern Ireland) 2006;
  - The Control of Noise (Codes of Practice for Construction and Open Sites) Order (Northern Ireland) SR 2002/303;
  - The Waste and Contaminated Land (Northern Ireland) Order 1997; and
  - The Waste Management Regulations (Northern Ireland) 2006.
- Northern Ireland Strategic Policies:
  - Shaping Our Future: The Regional Development Strategy for Northern Ireland 2025 (RDS);
  - A Planning Strategy for Rural Northern Ireland (PSRNI);
  - Regional Transport Strategy 2002-2012 (RTS);
  - Regional Strategic Transport Network Transport Plan 2015 (RSTN TP);
  - Investment Strategy for Northern Ireland (ISNI) 2008-2018;
  - Investment Delivery Plan (IDP) for Roads;
  - Belfast Metropolitan Transport Plan (BMTP) 2015;
  - Belfast Metropolitan Area Plan (BMAP) 2015;
  - Larne Area Plan 2010;
  - Pre-Draft Antrim, Ballymena and Larne Area Plan 2016;
  - Local Air Quality Management Policy Guidance Northern Ireland LAQM.PGNI(09);
  - Northern Ireland Biodiversity Strategy (NIBS) 2002;
  - Northern Ireland Biodiversity Implementation Plan 2005-2008;
  - Northern Ireland Habitat and Species Action Plans;
  - Northern Ireland River Conservation Strategy; and

- A Sustainable Development Strategy for Northern Ireland.
- Northern Ireland Planning Service Planning Policy Statements (PPS):
    - PPS1: General Principles (DOE March 1998);
    - PPS2: Planning and Nature Conservation (DOE June 1997);
    - PPS3: Access, Movement and Parking (DOE Feb 2005);
    - PPS 3 (Clarification): Access, Movement and Parking
    - PPS6: Planning, Archaeology and The Built Heritage (DOE March 1999);
    - PPS8: Open Space, Sport and Outdoor Recreation (February 2004);
    - PPS11: Planning and Waste Management (DOE December 2002);
    - PPS13: Transportation and Land Use (DRD February 2005);
    - PPS15: Planning and Flood Risk (DOE June 2006);
    - PPS21: (Draft) Sustainable Development in the Countryside (DOE November 2008); and
    - Development Control Advice Note 10 (DCAN10) Environmental Impact Assessment (DOE 1999).

17.2 Summary of Key Policies and Plans

17.2.1 The Regional Development Strategy for Northern Ireland 2025: Shaping Our Future (RDS)

The Regional Development Strategy (RDS) was prepared and delivered under the Strategic Planning (Northern Ireland) Order 1999. The strategy sets out the strategic planning framework for the development of Northern Ireland over a 25 year period and forms the top tier of planning legislation.

The Spatial Development Strategy (SDS) was developed as part of the RDS. It is designed to promote balanced integration and growth across the network of cities, towns and rural areas. The strategy is designed as a ‘hub, corridor and gateway framework’ for identifying plans and objectives. This includes ‘creating an upgraded and integrated transport system’ built around the Regional Strategic Transport Network of Key Transport Corridors (KTCs). The SDS states that *"The Regional Development Strategy will provide an important planning framework for tackling the deficiencies in our infrastructure and helping the overall development of our economy and society"*

One of the key functions of the RDS is to provide the spatial framework to accommodate the development of Northern Ireland’s transport network. The RDS recognises that Northern Ireland is almost totally dependent on a roads based transport system, with 98% of goods being transported by road. Consultation for the RDS identified the need to improve road infrastructure as a key requirement for economic development.

Key policies include:

- SPG-TRAN 1: Developing a regional strategic transport network;
- SPG-TRAN 2: Extending travel choice;

- SPG-TRAN 3: Integrating land use and transportation; and
- SPG-TRAN 4: Changing travel culture and contributing to healthier lifestyles.

The strategic planning guidance of the RDS sets out a range of measures to guide developers and the community towards achieving sustainable development, conserving the environment, enhancing biodiversity and creating a better quality of life for all.

Key environment policies include:

- SPG-ENV 1.1: Sustain and enhance biodiversity;
- SPG-ENV 1.2: Protect and manage areas designated for their scientific interest; and
- SPG-ENV 3.1: Safeguard the archaeological resource.

SPG-ENV 6 seeks to create healthier living environments and to support healthy lifestyles through improving air quality by changing travel patterns to reduce the growth of traffic (SPG-ENV 6.1); and combat and reduce water pollution by ensuring that arrangements for treatment of sewage from all forms of development meet environmentally acceptable standards.

The RDS also seeks to extend travel choice for all sections of the community by enhancing public transport (SPG-TRAN 2) and to integrate land use and transportation (SPG-TRAN 3)

General Principle 2 of PPS 13 advocates accessibility by modes of transport other than the private car should be a key consideration in the location and design of development. While General Principle 9 states that reliance on the private car should be reduced through a modal shift to walking, cycling and public transport.

Policy Compliance: *The proposed A8 Dualling scheme is consistent with the principles of the RDS in that it aims to provide a high quality, safe transport environment for all travellers whilst safeguarding the sensitive environments located within the scheme assessment area. The dualled A8 would deliver a scheme which facilitates the transport objectives identified above through the upgrading of the remaining 14km section of the Belfast to Larne Road and Eastern Seaboard KTC. The development provides a sensitive solution to the ecological and archaeological constraints of the scheme assessment area including the Lowtown Rath which provides a key visual landmark.*

17.2.2 The Regional Transportation Strategy for Northern Ireland 2002 –2012 (RTS)

The RTS represents a clear framework for the delivery of the transport aims of the RDS. The strategy sets out the programme towards the delivery of the transportation vision over the ten-year period 2002-12. The strategy outlines the delivery structures and identifies the transport plans through which it would be implemented, namely the:

- Regional Strategic Transport Network Transport Plan (RSTN TP);
- Belfast Metropolitan Transport Plan (BMTP); and
- Sub-Regional Transport Plan (SRTP).

The transportation vision of the RTS and RDS is "*to have a modern, sustainable, safe transportation system which benefits society, the economy and the environment and which actively contributes to social inclusion and everyone's quality of life.*"

The RTS is a 'daughter document' of the RDS and all transportation proposals which have a regional, or sub-regional significance, will be considered in the context of the RDS and the ten year RTS.

The RTS provides a commitment to develop and maintain the RSTN to enhance accessibility on an integrated basis for all users, and to examine access to regional gateways and cross border links, with an emphasis on improving connections from the five KTCs and four Link Corridors.

Policy Compliance: *The strategy identifies the A8 Dualling scheme as an element of the Strategic Highway Improvement programme, which indicates further support and need for the scheme at the regional level.*

17.2.3 Regional Strategic Transport Network Transport Plan (RSTN TP) 2015

The purpose of the RSTN TP is to plan the maintenance, management and development of Northern Ireland's Strategic Transport Network in accordance with the strategic direction and underlying principles of the RTS.

The RSTN TP comprises of five KTCs, four Link Corridors and the Belfast Metropolitan Area (BMA) Corridors, along with the remainder of the trunk road network. The RSTN TP confirms the individual schemes and projects to be implemented (subject to economic and other assessments, statutory processes and the availability of resources) to support the RDS and RTS objectives and targets.

Regional level support for the dualling scheme is provided by the A8 being defined as part of the Eastern Seaboard KTC together and within the Strategic Road Improvements (SRIs). SRIs are major projects where the scheme cost is estimated to exceed £1.0m. The RTS recognises the key role that SRIs will play in delivering a modern, safe and sustainable transport system for Northern Ireland. It envisaged significantly increased investment in SRIs, focussed on removing bottlenecks on the RSTN.

Policy Compliance: *The A8 Dualling scheme is consistent in its aim to deliver the objectives of the RTS and the RDS, through the implementation of the proposals of the RSTN TP. The A8 has been recognised as part of the Eastern Seaboard KTC and as such has priority within the Plan in terms of addressing problems on the RSTN and providing value in improving gateway and cross-border links between schemes on the Eastern Seaboard KTC and access to the Ports of Belfast and Larne.*

17.2.4 Investment Delivery Plan (IDP) for Roads

The IDP for roads outlines the government's strategy and programme for investment in the regional and local road network to deliver the key transport objectives of the RDS "*to have a modern, sustainable, safe transportation system which benefits society, the economy, and the environment and which actively contributes to social inclusion and everybody's quality of life*".

The RDS places transport provision at the heart of its strategy for creating a modern economy. The need for an efficient transport system is outlined as being key to Northern Ireland's ability to compete in the global marketplace. The IDP states that the Roads Service believes that meeting the Regional Development Strategy objective will require upgrading all of the KTCs to at least dual carriageway standard. For the period of the plan (2008/09 to 2017/18), Roads Service's indicative budget has risen to £3.1 billion over the 10 year period. Of this amount just under £2.5 billion is proposed for SRIs, of which £2.1 billion is for dualling projects on the KTCs.

Policy Compliance: *The A8 Dualling scheme (Eastern Seaboard Corridor) is outlined within the IDP as a key project. The scheme along with the A5 Western Corridor has received a £400m contribution from the Irish Government to help fund both major road schemes. The A8 improvements have been highlighted as important for enhancing the link from the Port of Larne to Belfast and Dublin, enhancing the potential for economic growth and development in the region. The A8 is one of eleven schemes within the Preparation Pool expected to start within the next five years (2008-2013) subject to satisfactory completion of the necessary procedures and the level of funding available at the time.*

17.2.5 Belfast Metropolitan Transport Plan

The BMTP is the local non-statutory transport plan for the Belfast Metropolitan Area (BMA) and takes forward the strategies and proposals of the RTS and relates them to the BMA. The key long-term aim of the BMTP reflects the aspirations of the RTS and RDS, to provide a safe, environmentally acceptable and sustainable transport system. The Plan sets out the transport proposals expected to be implemented by 2015.

The BMTP recognises the importance of the transport network to providing access to regional gateways and the rest of Europe; as such the Plan recognises the importance of the BMA transport network to connect local airports and ports, including the Port of Larne via the Eastern Seaboard Corridor. The Plan identifies the A8 as the strategic link between Belfast, via the M2 motorway to the Regional Gateway of Larne. The road is highlighted as a key element of the RSTN and noted that it has been improved with road widening schemes and heavy goods vehicle crawler lanes in recent years. The Plan proposes that options to complete the dualling of the A8 are retained.

Key transport problems identified by the Plan include; increased traffic levels and localised traffic congestion at peak times, impact of traffic on the environment, road safety and limited provision for walking and cycling.

Policy Compliance: *The A8 Dualling scheme is consistent with the aims of the BMTP in that the completion of the scheme would fulfil the recommendation of the Plan to complete the dualling of the A8 and help reduce traffic pressures on the road and improve links along the Eastern Seaboard Corridor to and from the Port of Larne. The scheme would also promote walking and cycling within the surrounding area through the provision of formal shared footways and cycleways, thereby increasing choice of transport modes for local communities. The scheme drainage design has been designed to minimise the impact on the surrounding environment and includes measures to reduce pollutants entering the environment from the road e.g. incorporation of petrol interceptors.*

17.2.6 Belfast Metropolitan Area Plan 2015

The BMA covers the settlements of Belfast City, Lisburn City, Carrickfergus Borough, Castlereagh Borough, Newtownabbey Borough and North Down Borough, representing a population of 646,550[115]. The key overarching aims of the BMAP are to conform to the principles of the RDS and to facilitate sustainable growth and high quality development within the BMA whist protecting and where appropriate, enhancing the natural and man-made environment of the Plan Area.

The A8 Belfast to Larne Road transects the boroughs of Newtownabbey and Larne (for Larne Area Plan see Section 17.2.7) and therefore consideration has been given to the proposals for Newtownabbey within the BMAP.

One of the key proposals for the whole of the BMAP is to develop and enhance the Metropolitan Transport Corridor Network (Policy SPG-BMA 3) and by improving connections to KTCs. The BMAP along with the supporting BMTP proposes the completion of the dualling of the A8 to improve road safety and reduce the impact of traffic.

Policy Compliance: *The A8 Dualling scheme is consistent with the policies and principles outlined within the BMAP in terms of the scheme delivering a completed dual carriageway environment between Belfast and Larne. This would contribute to helping achieve the aims of the BMAP in terms of improving connections to KTCs as well as improving safety and reducing traffic pressures on this busy route between Belfast and the Port of Larne. A comprehensive assessment of the effects upon adjacent habitats, including trees and the main rivers has been carried out with appropriate mitigation identified to ensure that the scheme has the minimum impact on local habitats and biodiversity in the long term.*

17.2.7 Larne Area Plan 2010

The Larne Area Plan was formally adopted in March 1998 with the purpose of informing the general public, statutory authorities, developers and other interested bodies of the policy framework and broad land use proposals which are to be used to guide development up to the year 2010 for the Borough of Larne. The Plan seeks to facilitate the physical, social and economic regeneration of the Borough through the policies and plans detailed within the Plan. Key aims of the Plan include the protection of areas of high landscape quality and open countryside, the protection of both designated sites and local sites of nature conservation interest and features of the historic landscape.

Key transportation policies identified within the plan include:

- Policy TR1 – The Department will facilitate traffic movement in Larne Borough by the provision of new roads and/or road improvements as resources permit.
- The Belfast to Larne Road is highlighted as a strategic route as part of the wider Euroroute network. The plan states that “The Department will continue to upgrade this road with the objective of improving the standard of safety and convenience for road users.”

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[115] Northern Ireland Census 2001

- Policy TR2 identifies the A8 Belfast to Larne Road as a 'protected route', as a result, development proposals within the area must take into consideration the effect on this route and plans for its upgrade.

Key environment policies include:

- Policy NV5 – The promotion of measures which will protect and enhance existing tree cover and hedgerows.
- MAN EN2 – The protection of sites and the settings of monuments in state care.

Policy Compliance: *The delivery of the A8 Dualling scheme is consistent with the aims of the Larne Area Plan in that it aims to produce a scheme design which would improve safety and provide convenient access to Larne from Belfast and the wider Eastern Seaboard. The scheme promotes good environmental standards in design including a landscape strategy which encourages the use of hedgerow planting and local species to integrate the scheme within its surroundings and which protects and reflects the sensitivity of the surrounding environment and the setting of the Lowtown Rath Scheduled Historic Monument (SHM). A comprehensive assessment of the effects upon adjacent habitats, including trees and the main rivers has been carried out with appropriate mitigation detailed to ensure that the scheme has a negligible impact on local habitats and biodiversity in the long term.*

17.2.8 Planning Policy Statement 1: General Principles (PPS1);

PPS1 was published in March 1998 and sets out the general principles that the DOE, observes in carrying out its planning functions, such as formulating planning policies, making development plans and exercising control of development.

The statement contains general policy guidance to encourage new sustainable development and high quality standards of design. This policy document realises the need to conserve both the built heritage and natural resources (including wildlife, landscape, water, soil and air quality), taking particular care to safeguard designations of national importance.

Policy Compliance: *The design of the A8 Dualling scheme is consistent with the principles of PPS 1 and sustainability. The proposed scheme follows a predominantly online route (of the 14km of the route approximately 5km is off-line; 1.5km section of the road to the east around the hamlet of Bruslee, and a 3.4km section to the west of Ballynure) reducing the amount of disturbed greenfield land. The scheme aims to reuse as much as possible of the materials cut from the land in other areas of the scheme, encouraging sustainable principles of design and construction throughout the scheme. In line with the principles of PPS 1 to preserve areas of built heritage and natural heritage, the A8 preliminary design has been developed to preserve the special qualities of the area including the Lowtown Rath SHM and avoid any detrimental impact upon its special interest.*

17.2.9 Planning Policy Statement 2: Planning and Nature Conservation (PPS2);

PPS 2 identifies areas designated for their nature conservation importance under both European and local legislation such as the The Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 (as amended), the Birds Directive and the The Nature Conservation and Amenity Lands (Northern Ireland) Order 1985 (as amended), which places emphasis on the establishment of a network of Areas of Special Scientific Interest (ASSIs) and National Nature Reserves (NNRs). The scheme assessment area for the A8 Dualling scheme does not contain any designated habitats. However, PPS 2 should still be considered in terms of compliance with general environmental and nature conservation principles and best practice.

PPS2 states that:

"development likely to have an adverse effect on recognised sites of local nature conservation importance will not be approved unless there are reasons for the proposal which outweigh the need to safeguard the intrinsic nature conservation value of the site".

PPS2 also provides protection and guidance for trees and woodlands and recognises their importance both as habitats and as strong visual elements in the landscape. Where possible, trees and hedgerows should be protected and retained where practicable, with additional trees and hedgerows planted where possible. Trees which are of special value or beauty may be protected by the Planning Service through the designation of a Tree Preservation Order (TPO).

Policy Compliance: *The location of the proposed scheme and its preliminary design takes into consideration the objectives and principles of PPS2 and aims to minimise any adverse environmental effects upon the local environment. The contractor for the construction of the scheme would be informed of areas which must be not be affected or used during the construction phase to minimise effects upon local habitats of importance. Appropriate pollution prevention control measures would also be employed to prevent and minimise adverse environmental effects upon local watercourses and aquatic flora and fauna.*

The preliminary design landscape proposals include the replacement of hedgerows affected by the scheme with appropriate local species to encourage integration and habitat generation along the scheme. The scheme also proposes to mitigate the loss of trees through appropriate replacement planting.

17.2.10 Planning Policy Statement 3: Access, Movement and Parking (PPS3);

PPS 3 aims to promote the objectives of the RDS and RTS through regional planning guidance. PPS 3 aims to protect routes designated as important to the strategic road network by restricting access and development which may affect future infrastructure schemes or road safety. The main objectives of PPS 3 relevant to the A8 Dualling scheme include:

- Promoting road safety, in particular, for pedestrians, cyclists and other vulnerable road users;

- Restricting the number of new accesses and control the level of use of existing accesses onto Protected Routes;
- Promoting parking policies that will assist in reducing reliance on the private car and help tackle growing congestion; and
- Making efficient use of road space within the context of promoting modal shift to more sustainable forms of transport.
- **Policy Compliance:** *The preliminary design has incorporated a new footway facility on sections of the western carriageway and at major junctions to facilitate pedestrian access from all residential properties to facilities and new bus stop facilities. A shared footway/cycleway will also be provided along the eastern carriageway, and through the settlement of Ballynure to maintain links to facilities within the village and new bus stop locations. Pedestrians would cross the dual carriageway via road bridges at the compact grade separated junctions. Where possible, private accesses have been accommodated on adjacent side roads. Where this has not been possible, a 'left in, left out' access has been provided to eliminate hazards involved in right hand turns.*

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

PPS 6 sets out the planning policies for the protection and conservation of archaeological remains and features of the built heritage. The A8 scheme assessment area contains heritage features of regional and local importance. They include the Lowtown Rath which has been designated as a Scheduled Historic Monument for its regional archaeological importance.

Policy BH 1 details the guidance and regulations for the Preservation of Archaeological Remains of Regional Importance and their Settings:

"'The Department will operate a presumption in favour of the physical preservation in situ of archaeological remains of regional importance and their settings. These comprise monuments in State Care, scheduled monuments and other important sites and monuments which would merit scheduling. Development which would adversely affect such sites of regional importance or the integrity of their settings will not be permitted unless there are exceptional circumstances."

Policy BH 2 deals with the Protection of Archaeological Remains of Local Importance and their Settings, states that:

"Development proposals which would adversely affect archaeological sites or monuments which are of local importance or their settings will only be permitted where the Department considers the importance of the proposed development or other material considerations outweigh the value of the remains in question."

There are no listed buildings within the scheme assessment area which would be affected by the scheme.

Policy Compliance: *The A8 Dualling scheme has been developed to be sympathetic and considerate to the features of the historic environment present within the scheme assessment area. A comprehensive consultation has been undertaken with the NIEA Built Heritage Department to ensure that any potential issues regarding the effects upon the setting of heritage features have been accommodated by the preliminary design.*

17.2.12 Planning Policy Statement 8: Open Space, Sport and Outdoor Recreation (PPS8);

PPS8 relates to the development of recreational, sport and amenity facilities and the protection of existing areas of open space used for recreational purposes. The policy aims to support the Government's commitment to the principles of sustainable development and the promotion of healthier lifestyles and protection of local biodiversity.

Policy OS 1 deals with the Protection of Open Space. It states "*The Department will not permit development that would result in the loss of existing open space…An exception will be permitted where it is clearly shown that redevelopment will bring substantial community benefits that decisively outweigh the loss of the open space…(and) where it is demonstrated that the loss of open space will have no significant detrimental impact on the amenity, character or biodiversity of an area…*"

Policy Compliance: *The A8 Dualling scheme would result in the loss of a small area of amenity land within the Clements Wood (Woodland Trust) located at the northern end of the scheme. However, the area of land to be taken to facilitate the new dual carriageway is not considered to be significant for the future viability of the wood and its amenity value. Consultation has been undertaken with the Woodland Trust regarding the effects at this location and to discuss the promotion of local biodiversity and the planting of native trees throughout the scheme where practicable to compensate for the loss.*

17.2.13 Planning Policy Statement 11: Planning and Waste Management (PPS11);

PPS11 relates to the development of waste management facilities, and thus is of limited direct relevance to the A8 Dualling scheme. However, the policy refers to land improvement through the disposal of inert waste and need for waste minimisation in new developments. This has implications for the scheme in terms of requiring a sustainable approach to waste management. The document states that waste should be disposed of or treated in reasonable proximity to the point of generation, and waste minimisation should be prioritised over waste disposal.

Policy Compliance: *The scheme proposals would include the production of a Site Waste Management Plan (SWMP) outlining how waste from the site will be treated and proposals for reuse.*

17.2.14 Planning Policy Statement 13: Transportation and Land Use (PPS13);

PPS13 has been prepared to assist in the implementation of the RDS and the RTS. It aims to guide the integration of transportation and land use, particularly through the preparation of development plans and transport plans, prepared by DOE Planning Service and DRD Roads Service.

The key principle of the RDS and RTS which has shaped PPS 13 and which is relevant to this scheme is SPG-TRAN 1, which aims "to develop a Regional Strategic Transport Network, based on key transport corridors, to enhance accessibility to regional facilities and services".

The document aims to create "*a modern, sustainable, safe transport system*"', to which the A8 Dualling scheme would contribute by upgrading infrastructure and improving safety along the route.

PPS13 also states "*Land required to facilitate improvements in the transport network should be afforded protection*". This reflects the RDS policy of identifying and safeguarding sites which could be critical in developing transportation infrastructure.

Policy Compliance: *The preliminary design aims to promote the objectives of the policy by promoting sustainable transport choices through the incorporation of footways, cycleways and the inclusion of safe formal bus stop locations to facilitate public transport choices and therefore contribute to sustainable transport and the principles of SPG-TRAN 2 of the RDS. The upgrading of this section of the A8 Belfast to Larne Road to dual carriageway standards would facilitate safe and efficient travel for all users along the Eastern Seaboard Corridor and contribute to the fulfilment of SPG-TRAN 1 of the RDS.*

17.2.15 Planning Policy Statement 15: Planning and Flood Risk (PPS15);

PPS 15 seeks to minimise flood risk to people, property and the environment. It includes the concepts of sustainable development and the conservation of biodiversity. The precautionary approach to development is also an important theme that takes account of climate change and supports the wellbeing and safety of people. In reference to the A8 Dualling, policies FLD1 development in flood plains, FLD3 development beyond flood plains and FLD4 flooding and land drainage would be of particular relevance to the scheme, due to parts of the scheme assessment area being at risk from flooding from a number of watercourses within the scheme assessment area. The main watercourses include the Larne River (also referred to as the Inver River) and the Six Mile Water and its tributaries which include the Ballynure Water.

Policy Compliance: *The A8 Dualling scheme would be exempt from Policies FLD1 and FLD3, as the location of the dualling is essential for operational reasons. The scheme would be exempt provided that the scheme undergoes an assessment of flood risk to ensure that the scheme is not at risk of flooding and that the risk is not materially increased elsewhere because of the scheme. Policy FLD4 is relevant as culverting would be required as part of the scheme, where it can be demonstrated that there is no practicable alternative. The flood risk assessment (FRA) and the proposals for culverting within the scheme are documented within chapter 11, Road Drainage and the Water Environment.*

17.2.16 Planning Policy Statement 21: Sustainable Development in the Countryside (PPS21)

Planning Policy Statement 21 has been recently published by the Planning Service for the control of countryside development. The aim of the policy is to manage development in a manner that is consistent with achieving strategic objectives of the RDS and which strikes a balance between the need to protect the countryside from unnecessary and inappropriate development while supporting rural communities.

Policy CTY 1 – Development in the Countryside sets out the main planning considerations for the control of development in the countryside:

"There are a range of types of development which in principle are considered to be acceptable in the countryside …All proposals for development in the countryside must be sited and designed to integrate sympathetically with their surroundings and to meet other planning and environmental considerations … There are a range of other types of non-residential development that may be acceptable in principle in the countryside, e.g. certain utilities or telecommunications development."

Annex 1 of PPS 21 supersedes the provision within PPS 3 Policy AMP 3 relating to Access to Protected Routes Outside Settlement Limits.

Policy Compliance: *The A8 Dualling scheme is consistent with the principles of PPS21. To limit the effects on the countryside, a predominantly online alignment with a bypass to the west of Ballynure was chosen during the optioneering process. This option limits the direct effects on the countryside and local communities. The upgrading of the A8 is considered to be necessary due to the roads perceived poor safety record, therefore in-line with Policy CTY1 - non-residential development deemed necessary for the future development of this rural community. PPS21 has assumed responsibility for 'Access to Protected Routes Outside Settlement Limits'. The proposals for access to the main carriageway have been limited to essential 'left in, left out' accesses where no alternative side road access is considered viable.*

17.2.17 Development Control Advice Note 10 Environmental Impact Assessment (DCAN10)

DCAN 10 provides guidance to developers on the interpretation of The Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 1999 (the Planning EIA Regulations) and how they will be applied in practice together with the requirements for the production of an Environmental Statement (ES) in support of a planning application.

The Regulations implement Council Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment, as amended by Directive 97/11/EC on the assessment of public and private projects on the environment insofar as it applies to development under the Planning (Northern Ireland) Order 1991.

The aim of the Environmental Impact Assessment process is to:

- Improve project design;
- Improve public participation;
- Lead to informed decision making; and
- Reduce environmental impact.

Policy Compliance: *The A8 Dualling scheme is compliant with the guidance of DCAN 10 as this ES has been undertaken in line with the EIA Regulations.*

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Part 3 – Summary Tables

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18 Summary Tables

18.1 Schedule of Environmental Commitments

Table 123 **Schedule of Environmental Commitments**

Mitigation Item No.	Approximate Chainage/ Location	Mitigation Objective and Commitment	Potential Mitigation Measure	Potential Timing of Mitigation Measure	Potential Monitoring Requirements	Potential Additional Consultation Required
Nature Conservation						
1	Areas of important trees	To protect remaining trees, and minimise tree loss where possible	Root protection zones (RPZ)	During construction	Ensure RPZ are maintained throughout construction	Woodland Trust, NIEA
2	Along scheme	Minimise habitat loss where possible	Reinstate hedgerows along road	During construction	Monitor success of replacement planting	NIEA
3	Watercourses used by otters	To maintain habitat connectivity for otters	Underpasses and fencing; replacement habitat (holt)	During operation	Monitor use of underpasses and replacement habitat	NIEA
4	Along scheme	To maintain habitat connectivity for bats	Hedgerows and bat 'hop-over' planting; temporary crossings during construction; replacement habitat	During construction and operation	Monitor use of hop-overs and replacement habitat (bat boxes/bricks)	NIEA
5	Badger habitat	To maintain habitat connectivity for badgers	Underpasses and fencing; replacement habitat (sett)	During operation	Monitor use of underpasses and replacement habitat	NIEA
6	Along scheme	To avoid adverse effects on birds	Timing of vegetation clearance works; replacement habitat	During construction	Monitor use of replacement habitat (nest boxes)	NIEA
7	Watercourses	To avoid adverse effects	Timing of works;	During construction	Monitor fish populations and	DCAL Inland

Mitigation Item No.	Approximate Chainage/ Location	Mitigation Objective and Commitment	Potential Mitigation Measure	Potential Timing of Mitigation Measure	Potential Monitoring Requirements	Potential Additional Consultation Required
		on fish	replacement habitat to equal or greater value to fisheries; pollution control measures	and operation	water quality in realigned watercourses	Waterways and Fisheries, NIEA
Landscape						
1	Scheme Wide	Subject to detailed design Integrate junction arrangements and bridge structures	Where planting cannot be provided to integrate the proposed bridge structures, or where structures are visually prominent in an elevated position, the bridge wing walls will receive a natural stone facing to reflect the local character of the landscape	On completion of the bridge construction within the wider construction programme	N/A	Site supervision to qualify materials and standard of workmanship
Cultural Heritage						
1	Scheme wide	Ensure that archaeological remains are recorded appropriately prior to and during construction	Archaeological testing options: -Geophysical survey of areas that would experience construction impacts to identify areas of archaeological potential; - Trial trenching of areas of interest to evaluate the presence and significance of the archaeological remains; -Strip-Map-Sample: topsoil	- Geophysical survey and trial trenching should be undertaken prior to the commencement of construction -Strip-Map-Sample would be undertaken during the site preparation phase. Sufficient allowance should be made within	The works would require to be monitored by the Employer's Representative and/or NIEA Built Heritage	NIEA

Mitigation Item No.	Approximate Chainage/ Location	Mitigation Objective and Commitment	Potential Mitigation Measure	Potential Timing of Mitigation Measure	Potential Monitoring Requirements	Potential Additional Consultation Required
			would be stripped under archaeological supervision, the location of archaeological remains would be mapped and then recorded through archaeological excavation	the construction programme to accommodate the archaeological works		
2	5+520	Ensure that the setting of Hillis Bridge is recorded	The bridge and its current setting will be recorded by photographic and measured survey	Pre Construction	The works would require to be monitored by the Employer's Representative and/or NIEA Built Heritage	NIEA
3	9+940	Ensure that a record is made of the former Headwood Station	The building and its current setting will be recorded by photographic and measured survey	Pre Construction	The works would require to be monitored by the Employer's Representative and/or NIEA Built Heritage	NIEA
4	10+600	Ensure that a record is made of possible historic remains	A buildings watching brief will be maintained during the demolition of the structure to record any historic elements of the former station that survive	During demolition	The works would require to be monitored by the Employer's Representative and/or NIEA	NIEA
5	13+600	Ensure that the impacts upon the setting of Lowtown Rath and souterrain are minimised	No specific mitigation is proposed; scheme planting proposals will largely ameliorate setting impacts over by opening+15 years	Construction and operational phases		N/A

Mitigation Item No.	Approximate Chainage/ Location	Mitigation Objective and Commitment	Potential Mitigation Measure	Potential Timing of Mitigation Measure	Potential Monitoring Requirements	Potential Additional Consultation Required
Geology and Soils						
1	Various areas where peat is present	Peat arisings to be placed as landscape fill along the route, to provide environmental value to potential future ecosystems	Peat arisings to be places as landscape fill along the route	During construction	Not required	N/A
2	Various areas of made ground	Avoid exposure of workers and environmental receptors to potentially contaminated materials	Control measures to be adopted during the construction process to ensure the appropriate management of existing site materials	Control measures to be identified prior to commencement of construction works, and implemented throughout the construction phase	To be confirmed by the contractor prior to the construction phase	N/A
3	All locations of the construction works, but in particular site compound areas	Prevent pollution spillages, and promptly clear polluting materials should a spillage occur	Control measures to be adopted during the construction process for the prevention of spillages and prompt clearance of potentially polluting materials should a spillage occur	Control measures to be identified prior to commencement of construction works, and implemented throughout the construction phase	To be confirmed by the contractor prior to the construction phase	N/A
4	All proposed drainage outfall locations	Prevent significant levels of contamination from road runoff polluting the ground beneath and adjacent to outfall locations	Incorporation of petrol interceptors at all proposed outfall locations	Design	Not required	N/A

Mitigation Item No.	Approximate Chainage/ Location	Mitigation Objective and Commitment	Potential Mitigation Measure	Potential Timing of Mitigation Measure	Potential Monitoring Requirements	Potential Additional Consultation Required
Road Drainage and the Water Environment						
1	Various locations	Reduction of silt arising from in channel works. Site specific best practice to be used during construction	Site specific risk assessments and working methods to be agreed for all in channel construction work	Construction phase	N/A	Rivers Agency, to agree method of working
2	Chainage 3+000 Outfall to Catchment 6	Reduction of dissolved Copper in surface water	Wetland treatment area within the attenuation pond	To be included in the scheme design, for use during operation	N/A	Rivers Agency – as part of the application for consent to discharge
Air Quality						
1	Throughout worksite, with special attention to adherence close to properties	To reduce the risk of construction dust nuisance	Comprehensive measures to reduce on-site dust emissions and impacts off-site (see Appendix I1.2)	During construction	Regular visual inspection of deposition at site boundaries close to properties	Consultation with local authorities confirming mitigation measures to be included in the CoCP
Noise and Vibration						
1 Construction noise Section 1	South of Coleman's Corner roundabout to the South of A57 roundabout	Reduce noise from construction activities associated with the proposed scheme build at noise sensitive dwellings adjacent to works along Section 1	Installation of partial and/or full acoustic screening measures to break line of sight between noise sensitive dwellings and the construction activities, screening material of minimum 7.5kg/m^2	To coincide with construction activities along section 1	None	With Local Authority as and when required by construction contractor

Mitigation Item No.	Approximate Chainage/ Location	Mitigation Objective and Commitment	Potential Mitigation Measure	Potential Timing of Mitigation Measure	Potential Monitoring Requirements	Potential Additional Consultation Required
2 Construction noise Section 2	North of A57 roundabout to Ballybracken Road	Reduce noise from construction activities associated with the proposed scheme build at noise sensitive dwellings adjacent to works along Section 2	Installation of partial and/or full acoustic screening measures to break line of sight between noise sensitive dwellings and the construction activities, screening material of minimum 7.5kg/m^2	To coincide with construction activities along section 2	None	With Local Authority as and when required by construction contractor
3 Construction noise Section 3	Ballybracken Road to the North of junction with A36	Reduce noise from construction activities associated with the proposed scheme build at noise sensitive dwellings adjacent to works along Section 3	Installation of partial and/or full acoustic screening measures to break line of sight between noise sensitive dwellings and the construction activities, screening material of minimum 7.5kg/m^2	To coincide with construction activities along section 3	None	With Local Authority as and when required by construction contractor
4 Operational noise	Facades of properties identified as NIR qualifiers and other areas subject to adverse noise impacts that are predicted to result in significant effects	To prevent or minimise significant effects or prevent exceedance of NIR threshold	Low Noise Surface Material	During construction of the scheme	N//A	N/A
5	1 property	To address properties	Noise Insulation measures in	TBC	N/A	Eligibility to be

Mitigation Item No.	Approximate Chainage/ Location	Mitigation Objective and Commitment	Potential Mitigation Measure	Potential Timing of Mitigation Measure	Potential Monitoring Requirements	Potential Additional Consultation Required
Operational noise		exceeding NIR threshold	accordance with NIR (Northern Ireland) for dwellings that experience noise levels exceeding the NIR threshold level of 68dB(A) $L_{Aeq, T}$			established with affected householders identified as requiring mitigation under NIR
Effects on All Travellers						
1	Scheme Wide	Reduce traveller stress and uncertainty	Advanced notice of temporary and permanent closure of existing footways, cycleways and roads. Information concerning road closures or diversion should be advertised in advance in the local press, via posters in supermarkets and by website or other means of communication such as local radio	Construction Phase	N/A	Local councils, Roads Service and Translink
2	Scheme Wide	Reduce traveller stress and uncertainty	Provision of clear signage of alternative routes and diversions.	Construction Phase	N/A	Local councils, Roads Service and Translink
3	Scheme Wide	Reduce traveller stress and uncertainty	Low level lighting or high visibility reflective screens, advanced signage or bollards of construction areas along the road at night should be	Construction Phase	N/A	N/A

Mitigation Item No.	Approximate Chainage/ Location	Mitigation Objective and Commitment	Potential Mitigation Measure	Potential Timing of Mitigation Measure	Potential Monitoring Requirements	Potential Additional Consultation Required
			implemented to warn vehicle travellers of the road conditions and construction activities (measures to be agreed by the contractor and the Roads Service prior to construction)			
Community and Private Assets						
N/A	N/A	N/A	N/A	N/A	N/A	N/A

18.2 Summary of Environmental Impacts

Table 124 **Summary of Environmental Impacts**

Item	**With Proposed Scheme**						**Do Minimum**
	Description of Potential Impact	**Mitigation Objective and Commitment**	**Sensitivity/ Value of Receptor**	**Duration of Impact Short/Long Term**	**Magnitude of Impact with Mitigation**	**Significance of Impact with Mitigation**	**Description of Likely Effects**
Nature Conservation							
1 Non-statutory designated Site	Loss of mature trees from Clements Wood	Root protection zones around remaining trees, minimise habitat loss where possible	County value, moderate sensitivity	Long term	Moderate	Significant	N/A
2 Habitats	Direct loss of habitats of local value. Includes trees, hedgerows and improved grasslands	Minimising habitat loss where possible, reinstating hedgerows along road	Local value, moderate sensitivity	Long term	Minor	Not significant	N/A
3 Mammals: Otter	Loss of habitat; disturbance; direct injury/death	Underpasses and fencing; replacement habitat	National value, moderate sensitivity	Short term	Minor	Significant	N/A
4 Mammals: Bats	Loss of habitat; disturbance; direct	Hedgerows and bat 'hop-over' planting; temporary crossings	National value, moderate	Short term	Minor	Significant	N/A

Item	**With Proposed Scheme**						**Do Minimum**
	Description of Potential Impact	**Mitigation Objective and Commitment**	**Sensitivity/ Value of Receptor**	**Duration of Impact** **Short/Long Term**	**Magnitude of Impact with Mitigation**	**Significance of Impact with Mitigation**	**Description of Likely Effects**
	injury/death	during construction; replacement habitat	sensitivity				
5 Mammals: Badger	Loss of habitat; disturbance; direct injury/death	Underpasses and fencing; replacement habitat	National value, moderate sensitivity	Short term	Minor	Significant	N/A
6 Breeding Birds	Loss of habitat; direct injury/death	Timing of vegetation clearance works; replacement habitat	Local value, moderate sensitivity	Short term	Minor	Not significant	N/A
7 Fisheries	Loss of habitat; direct injury/death; water contamination	Timing of works; replacement habitat to equal or greater value to fisheries; pollution control measures	Local value; moderate sensitivity	Short term	Minor	Not significant	N/A
Landscape							
1	Off-line dualled A8 at Bruslee	*Objective:* Integration of the off-line section in to the landscape *Commitment:* Replacement of vegetation lost during construction. Screen planting along to	**Landscape**				
			Low to medium	Long term	Minor magnitude of change by the design year	Slight Adverse by the design year	The landscape design has been developed as an integral part of the scheme design. These measures are not considered to be mitigation measures and consequently the

Item	With Proposed Scheme						Do Minimum
	Description of Potential Impact	Mitigation Objective and Commitment	Sensitivity/ Value of Receptor	Duration of Impact Short/Long Term	Magnitude of Impact with Mitigation	Significance of Impact with Mitigation	Description of Likely Effects
		integrate the off-line alignment					scheme has not been assessed without these measures in place
			Visual				
			Visual receptors range from low to high sensitivity	Long term	Major adverse to minor beneficial. (Refer to drawings A8-S3-3118 to 3122 for visual receptor effect)	By the design year the effect ranges from Slight beneficial to the east of the existing A8 to Substantial adverse to the west. (Refer to drawings A8-S3-3118 to 3122 for visual receptor effect)	The landscape design has been developed as an integral part of the scheme design. These measures are not considered to be mitigation measures and consequently the scheme has not been assessed without these measures in place
2	Introduction of grade separate junctions	Objective: Integration of the grade separated junctions into the landscape Commitment: Allowance for	**Landscape**				
			Low to medium	Long term	Minor magnitude of change by the design year	Slight Adverse by the design year	Refer to item 1
			Visual				

Item	With Proposed Scheme						Do Minimum
	Description of Potential Impact	**Mitigation Objective and Commitment**	**Sensitivity/ Value of Receptor**	**Duration of Impact Short/Long Term**	**Magnitude of Impact with Mitigation**	**Significance of Impact with Mitigation**	**Description of Likely Effects**
		additional planting at the top of embankment slopes. Planting of junction side slopes Mass planting around junction arrangements	Visual receptors range from low to high sensitivity	Long term	Major adverse to minor adverse. (Refer to drawings A8-S3-3118 to 3122 for visual receptor effect)	Ranging from Neutral to Substantial adverse effect by the design year. (Refer to drawings A8-S3-3118 to 3122 for visual receptor effect)	Refer to item 1
3	Loss of hedgerows and field boundary walls	Objective: Replace vegetation lost during construction. Commitment: Planting of native hedgerows with trees to reflect the character of the landscape	**Landscape**				
			Low to medium	Medium term	Minor magnitude of change by the design year for off-line sections. Neutral effect for online sections	Neutral effect by the design year with a slight adverse effect at off-line sections	Refer to item 1
			Visual				
			Visual receptors range from	Medium term	Major adverse to minor adverse. (Refer	By the design year the visual effect arising	Refer to item 1

Item	With Proposed Scheme						Do Minimum
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			low to high sensitivity		to drawings A8-S3-3118 to 3122 for visual receptor effect)	from the loss of these features would be predominantly Neutral (Refer to drawings A8-S3-3118 to 3122 for visual receptor effect)	
4.	Severance of field pattern	Objective: Replace vegetation lost during construction and repair field pattern Commitment: Planting of native hedgerows with trees to reflect the character of the landscape	**Landscape**				
			Low to medium	Medium term	Minor magnitude of change by the design year for off-line sections. Neutral effect for online sections	Neutral effect by the design year with a slight adverse effect at off-line sections	
			Visual				
			Visual receptors range from low to high	Long term	Major adverse to minor adverse. (Refer to drawings A8-	Ranging from Neutral to Substantial adverse effect	Refer to item 1

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			sensitivity		S3-3118 to 3122 for visual receptor effect)	by the design year. (Refer to drawings A8-S3-3118 to 3122 for visual receptor effect)	
5	Off-line section of the dualled A8 north of Ballynure	Objective: Integrate the off-line alignment into the landscape Commitment: Mass planting along at junction location. Screen planting along boundary of dualled A8. Planting at realigned A57	**Landscape**				
			Low to medium	Long term	Minor magnitude of change by the design year	Slight Adverse by the design year	Refer to item 1
			Visual				
			Visual receptors range from low to high sensitivity	Long term	Major adverse to minor adverse (Refer to drawings A8-S3-3118 to 3122 for visual receptor effect)	Ranging from Neutral to Substantial adverse effect by the design year. (Refer to drawings A8-S3-3118 to 3122 for visual receptor effect)	Refer to item 1
6	Introduction of alternative access	Objective: Repair the field	**Landscape**				
			Low to	Medium term	Negligible	Neutral effect	Refer to item 1

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	arrangements	boundary pattern Commitment: Replace vegetation lost during construction	medium		adverse by the design year	by the design year	
			Visual				
			Visual receptors range from low to high sensitivity	Medium term	Major adverse to minor adverse. (Refer to drawings A8-S3-3118 to 3122 for visual receptor effect)	Ranging from Neutral to Substantial adverse effect by the design year. (Refer to drawings A8-S3-3118 to 3122 for visual receptor effect)	Refer to item 1
Cultural Heritage							
1	Destruction of buried archaeological remains	Ensure that as yet undiscovered archaeological remains are recorded appropriately prior to construction	Not known	Permanent	N/A	Slight Adverse	No change from existing
2	Impact upon the setting of	Minimise impacts upon the setting of the	High value	Long	N/A	Slight Adverse	No change from existing

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	Lowtown Rath and Souterrain by increased proximity to the A8	monument					
3	Impact upon setting of Hillis Bridge	Preserve by record the structure of the bridge	Low	Permanent	N/A	Slight adverse	No change from existing
4	Impact upon former Headwood Station	Ensure that a record is made of possible historic remains	Low	Permanent	N/A	Slight Adverse	No change from existing
5	Impact upon section of former narrow gauge railway	Ensure that remains of the railway are preserved by record	Low	Permanent	N/A	Slight Adverse	No change from existing
6	Impact on possible location of souterrain	Ensure that the remains of the souterrain are preserved by record	Low	Permanent	N/A	Slight Adverse	No change from existing
Geology and Soils							
1	Removal or remediation of areas of peat from beneath the Preferred Route	Peat arisings to be placed as landscape fill along the route, to provide environmental value to potential	Low	Long term	Minor adverse	Neutral	Existing localised areas of peat relocated to new landscaped area

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		future ecosystems					
2	Excavation and removal of glacial deposits from the landscape to from cuttings	Not required	Negligible	Long term	Negligible	Neutral	Area of glacial till deposits removed from the Preferred Route and placed as embankment fill or landscape fill at appropriate locations
3	Excavation of cuttings into basalt bedrock	Not required	Low	Long term	Moderate beneficial	Slight beneficial	Basalt rock exposures created along the main cuttings along the Preferred Route
4	Construction of the scheme triggers potential ground movement / subsidence associated with historic mining	Not required	Negligible	Long term	Negligible	Neutral	Very low risk of potential ground movement in the vicinity of the route
5	Removal of existing areas of made ground, which have potential to	Avoid exposure of workers and environmental receptors to potentially contaminated materials	Low	Long term	Moderate beneficial	Slight beneficial	Safe disposal or capping of existing areas of potential contamination where present, reducing

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	contain contaminated material, for the construction of the scheme						future risk of impact to receptors
6	Exposure of workers and environmental receptors to previously unidentified areas of contamination uncovered during the works	Avoid exposure of workers and environmental receptors to potentially contaminated materials that may become uncovered	Low	Short term	Negligible	Neutral	Safe disposal or capping of existing areas of potential contamination where present, reducing future risk of impact to receptors
7	Potential spillage of polluting materials such as fuels, oils and liquid chemicals during the construction works	Prevent pollution spillages, and promptly clear polluting materials should a spillage occur	Low	Short term	Negligible	Neutral	Any potential spillages promptly and safely cleared to prevent impact to receptors
8	Potential contamination of	Prevent significant levels of contamination	Low	Long term	Minor adverse	Neutral	Minor adverse affect on soil conditions

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	soils and solid geology by the drainage system	from road runoff polluting the ground beneath and adjacent to outfall locations					local to proposed discharge points, similar to current scenario with existing road
9	Potential contamination of soils and solid geology by air borne pollutants from the proposed road	Not required	Negligible	Long term	Minor adverse	Neutral	Minor adverse affect on soil conditions immediately adjacent to the proposed road, similar to current scenario with existing road
Road Drainage and Water Environment							
1	Pollution from spillages and silt pollution in watercourses due to in channel work	Reduction of silt arising from in channel works. Site specific best practice to be used during construction. CoCP to be used for construction work phase	High Good status water quality	Short term	Minor	Slight / moderate adverse	No effects as there will be no in channel works
2	Pollution from spillages and silt pollution in	Reduction of silt arising from in channel works. Site specific	Very High – Salmonid watercourse	Short term	Minor	Moderate/large adverse	No effects as there will be no in channel works

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	watercourses due to in channel work	best practice to be used during construction. CoCP to be used for construction work phase					
3	Pollution of groundwater due to spillages	CoCP to be used for construction work phase	Medium	Long term / permanent	Slight	Slight / moderate adverse	No effects
4	High dissolved copper levels in surface water outfall into Green Burn	Reduction of dissolved copper in surface water runoff through treatment in wetland area	Very High – Salmonid watercourse	Long term	Negligible	Neutral	Assuming equivalent traffic flows the levels of dissolved copper in surface water in excess of runoff specific threshold resulting in chronic effects on freshwater ecology
5	Impact to groundwater from discharges to soakaway at Discharges 1, 10a and 17	The extent of effect has been restricted to a radius of 40m. There are no other receptors, such as abstractions, within this area. No mitigation is proposed	Medium	Permanent	Medium	No mitigation. Effect is moderate adverse	Assuming equivalent traffic flows

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Air Quality							
1	Construction dust nuisance	Comprehensive measures to reduce on-site dust emissions and impacts off-site (see Appendix I1.2)	Medium	Short term	High risk of nuisance	Medium/low risk of nuisance	None
2	Exposure to NO_2	No mitigation suggested	Sensitive	Long Term	Minor/low priority. Concentrations below statutory levels	N/A	Concentrations below statutory levels
3	Exposure to PM_{10}	No mitigation suggested	Sensitive	Long term	Minor/low priority. Concentrations below statutory levels	N/A	Concentrations below statutory levels
Noise and Vibration							
1	Exceedance of NIR threshold criteria, 1 residential property	Qualifies for noise insulation under the Noise insulation regulations (Northern Ireland)	Noise sensitive receiver (NSR) residential	Long Term	Adverse	Not significant	20 residential properties (dwellings) where identified as eligible for noise insulation under the

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	(dwelling) eligible under NIR (Northern Ireland)		properties (dwellings				Noise Insulation Regulations (Northern Ireland)
2	Operational noise decreases	None	Noise sensitive receiver (NSR) residential properties (dwellings)	Long Term	Mitigation for operational noise decrease is not necessary. With proposed mitigation intended to reduce operational noise increase: Ranges from moderate to major beneficial impact	Mitigation for operational noise decrease is not necessary With proposed mitigation intended to reduce operational noise increase Significant beneficial effects	The estimated numbers of dwellings predicted to receive a decrease in noise level of 3-5dB is predicted to be 26. The total number of dwellings predicted to experience a noise level decrease of >5dB is estimated to be 24
3	Operational night-time Noise	Change to night time noise is not expected,	Noise sensitive	Long Term	Mitigation particularly for	Mitigation particularly for	A significant change in the nature of the

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		therefore no mitigation recommended	receiver (NSR) residential properties (dwellings)		operational night-time noise is not necessary. With proposed mitigation intended to reduce operational noise increase: Negligible	operational night-time noise is not necessary. With proposed mitigation intended to reduce operational noise increase: Not Significant	traffic on the new dualled A8 is not expected. As such, it is expected that the proportion of daytime to night-time traffic flows will remain largely unchanged from the current levels as a result of the scheme, and that night-time noise levels will remain at least 10dB below daytime noise levels
4	Operational night-time Noise	Change to night time noise is not expected, therefore no mitigation recommended	Noise sensitive receiver (NSR) residential properties (dwellings)	Long Term	Mitigation particularly for operational night-time noise is not necessary. With proposed mitigation	Mitigation particularly for operational night-time noise is not necessary. With proposed mitigation	A significant change in the nature of the traffic on the new dualled A8 is not expected. As such, it is expected that the proportion of daytime to night-time traffic flows will remain

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					intended to reduce operational noise increase: Negligible	intended to reduce operational noise increase: Not Significant	largely unchanged from the current levels as a result of the scheme, and that night-time noise levels will remain at least 10dB below daytime noise levels
Effects on All Travellers							
1	Potential loss of footway/ cycleways during construction	Maintain access to bus stops. (To be agreed by Translink, Roads Service and the Contractor.)	Low	Short Term	Minor Adverse	Slight Adverse	Loss of existing formal provision during construction, however bus stop provision would be maintained throughout the scheme. Temporary footway provision to be detailed by the contractor
2	Increased severance during the construction phase.	N/A	Low	Short Term	Minor Adverse	Slight Adverse	Potential for increased severance during the construction phase

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							within Bruslee and Ballynure due to increased construction vehicles on local roads. Effects would be temporary and relative to the area under construction
3	Travel delays during construction	Appropriate traffic management and advanced information	Low	Short Term	Minor Adverse	Slight Adverse	The construction of the road will require times when sections of the road are reduced to one lane, require temporary road closures and/or road diversions, resulting in additional travel time and delay
4	Increased traveller stress during construction	Appropriate traffic management and advanced information	Low	Short Term	Minor Adverse	Slight Adverse	The construction of the road will require times when sections of the road are reduced to one lane,

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							require temporary road closures and/or road diversions which may result in increased levels of traveller stress
5	Improved pedestrian / cyclist provision and bus stop strategy	The scheme design includes the provision of shared footway/cycleway on eastern carriageway, and intermittent footway on western carriageway to link residential properties to bus stops. These measures are not considered to be mitigation	Low	Long Term	Major Beneficial	Moderate Beneficial	The provision of safe formal pedestrian provision to and from bus stops and local facilities has been assessed as a major improvement to existing provision with a moderate beneficial effect
6	New severance due to operation	N/A	N/A	Long-term	Moderate Adverse	N/A	The construction of a dual carriageway restricts opportunities for crossing the carriageway to the

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							main junctions. The additional travel distance may put off some potential travellers from making journeys
7	Completion of the Eastern Seaboard Corridor (KTC)	N/A	High	Long Term	Major Beneficial	Large Beneficial	The operation of the scheme would fulfil the objectives within the RDS and RTS for the A8. The scheme would reduce travel time, delays and improve access to the Port of Larne
Community and Private Assets							
1	Community Effects – Relief of Severance Overall Effect on Community due to Operation	Reduce severance within settlements	N/A Low	Long Term Long Term	Substantial Beneficial Major Beneficial	N/A Moderate Beneficial	Removal of through traffic through Bruslee and Ballynure resulting in significantly reduced severance currently experienced in the

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							villages
2	Loss of Private Property	Minimise loss of private assets. No mitigation measures proposed.	Low	Long Term	Major	Moderate Adverse	Five residential properties lost due to the construction of the scheme
3	Loss of Agricultural Land	Minimise loss of agricultural land.	N/A	Long Term	36 Slight Adverse effects, 3 Moderate Adverse effects, 4 Significant Adverse effects on individual farms.	N/A	Effects vary across the scheme. Typical effects include additional travel distances and time and land severance
4	Effect on Commercial Property – Construction	Minimise loss of commercial property	Low	Long Term	Slight Adverse	Slight Adverse	Land-lost from three commercial properties including loss of up to 4 buildings. Effects not considered to be significant
	Operation	Minimise negative effects on commercial property	Low	Long Term	Moderate Beneficial to Moderate Adverse	Slight Beneficial to Slight Adverse	Better transport links for access to the region for commercial

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							businesses. Loss of through traffic/customer base for local commerce