Chapter 19 Mitigation Measures

19.1. Introduction

Mitigation measures are the measures proposed in order to avoid, reduce or where possible remedy the significant adverse environmental effects of the proposed development. Mitigation measures have been incorporated into the design of the proposed road development and will be applied during both the construction and operation phase where they have been assessed as necessary.

The following chapter provides a summary of the mitigation measures for the proposed road development as contained within the preceding chapters (Chapter 4, and 6 – 17) of the EIAR. This is a summarised version stating only the mitigation measure to be provided and does not discuss the requirement for the measure to be applied or the residual impacts. This chapter also deals only with mitigation measures to be applied to the proposed road development and is in addition to the avoidance or reduction mitigation which has been previously applied through the iterative development of the design.

19.2. General Commitments

No.	Description
2.1	All of the mitigation measures (measures to avoid, prevent, or reduce significant adverse effects on the environment), controls, procedures and other requirements described in the EIAR and NIS prepared for the proposed road development shall be implemented in full.
2.2	Prior to any demolition, excavation or construction a Construction Management Plan (CMP) will be produced by the successful contractor. A CMP is prepared by the Contractor during the pre-construction phase, to ensure commitments included in the statutory approvals are adhered to, and that it integrates the requirements of the Construction Sediment Erosion Control Plan (CSECP), Environmental Operating Plan (EOP) and the Waste Management Plan (WMP). The Contractor will be required to include details under the following headings; • Details of working hours and days; • Details of emergency plan - in the event of fire, chemical spillage, cement spillage, collapse of structures or failure of equipment or road traffic incident within an area of traffic management. The plan must include contact names and telephone numbers for: Local Authority (all sections/departments); Ambulance; Gardaí and Fire Services; • Details of chemical/fuel storage areas (including location and bunding to contain runoff of spillages and leakages); • Details of construction plant storage, temporary offices; • Traffic management plan (to be developed in conjunction with the Local Authority – Roads Section) including details of routing of network traffic; temporary road closures; temporary signal strategy; routing of construction traffic; programme of vehicular arrivals; on-site parking for vehicles and workers; road cleaning; other traffic management requirements; • Truck wheel wash details (including measures to reduce and treat runoff); • Dust management to prevent nuisance (demolition & construction); • Site run-off management; • Noise and vibration management to prevent nuisance (demolition & construction);

No.	Description
	• Landscape management; • Management of demolition of all structures and assessment of risks for same; • Stockpiles; • Project procedures & method statements for; • Demolition & removal of buildings, services, pipelines (including risk assessment and disposal); • Diversion of services; • Excavation and blasting (through peat, soils & bedrock); • Piling; • Construction of pipelines; • Temporary hoarding & lighting; • Borrow Pits & location of crushing plant; • Storage and Treatment of peat and soft soils; • Disposal of surplus geological material (peat, soils, rock etc); • Protection of watercourses from contamination and silting during construction; • Site Compounds.
2.3	The TII Environmental and Construction Guidelines provide guidance with regard to environmental best practice methods to be employed in construction on National Road Schemes and will be complied with in the construction and operation of the proposed road development.
2.4	The Contractor will be required to complete an Environmental Operating Plan (EOP) in accordance with the NRA/TII *Guidelines for the Creation and Maintenance of an Environmental Operating Plan*. The EOP will set out the Contractors approach to managing environmental issues associated with the construction of the road and provide a documented account to the implementation of the environmental commitments set out in the EIAR and measures stipulated in the planning conditions. Details within the plan will include; • All Environmental commitments and mitigation measures included as part of the planning approval process and any requirements of statutory bodies such as the National Parks and Wildlife Services as well as a method documenting compliance with the measures; • A list of all applicable environmental legislation requirements and a method of documenting compliance with these requirements; • Outline methods by which construction work will be managed to avoid, reduce or remedy potential adverse impacts on the environment. To oversee the implementation of the EOP the Contractor will be required to appoint a responsible manager to ensure that the mitigation measures included in the EIAR, the EOP and the statutory approvals are executed in the construction of the works and to monitor that those mitigation measures employed are functioning properly.
2.5	Included within the CMP will be the Waste Management Plan (WMP) which clearly sets out the Contractor's proposals regarding the treatment, storage and disposal of waste. An outline WMP has been prepared for the proposed road development. The WMP is a live document that will be amended and updated to reflect current conditions on site as the project progress. The obligation to develop, maintain and operate a Waste Management Plan will form part of the contract documents for the project. The plan itself will contain (but not be limited to) the following measures; • Details of waste storage to be provided for different waste; • Details of where and how materials are to be disposed of - landfill or other appropriately licensed waste management facility; • Details of storage areas for waste materials and containers; • Details of how unsuitable excess materials will be disposed of where

No.	Description
	necessary; • Details of how and where hazardous wastes such as oils, diesel and other hydrocarbon or other chemical waste are to be stored and disposed of in a suitable manner; • A construction and demolition waste plan.
2.6	A detailed Construction Erosion and Sediment Erosion Control Plan (CESCP) has been prepared for this proposed road development and is included in Appendix 10.1 of this EIAR. All of the measures, mitigations, controls, requirements, procedures, etc. included therein will be implemented in full and will ensure that sediment laden runoff from the construction site does not enter watercourses or water bodies. The contract documents for the proposed development will place an obligation on the construction contractor to further develop this plan to include any additional requirements stipulated by An Bord Pleanála should the proposed road development be approved. In addition, the exact details of the plan, particularly in relation to construction phasing, sequence or layout, may be amended by the Contractor to reflect different construction approach but in any case shall include all of the measures, mitigations, controls, requirements, procedures, etc. included this plan. The CSECP sets out the minimum requirements that must be adhered to. Any alternative measures that may be incorporated at the construction stage will be required to provide at least the same, or, a better standard of protection. It will be a requirement of the contract documents that the finalised CSECP is assessed by the Employer's Site Representative Staff, including the Environmental Assurance Officer, to certify that it fully addresses the environmental requirements of the proposed road development as detailed in this EIAR, the Natura Impact Statement and any additional requirements imposed by An Bord Pleanála.

19.3. Mitigation Measures for Population & Human Health

No.	Description
3.1	The road design process and public consultation has allowed for the inclusion of mitigation measures such as junction improvements, pedestrian and cycle facilities and crossing facilities at roundabouts at Strokestown and Lavally Road, and an underpass at Ch 13+950 (for local walking and bog access). A footpath is proposed between the junction on Lavally Road and community facilities in Strokestown.
3.2	Other mitigation measures included in the road design include, for journey amenity, staggered junctions with minor roads and a roundabout between the N61 and R369, and for general amenity and severance, new cemetery access and parking in Strokestown, a refuge area for pedestrian/cyclists crossings of the road development from the LP1405, and underpasses for walking routes in Bellanagare and Scramoge, supplemented in the former case by additional looped walking facilities to the north and south of the proposed road development. .
3.3	Dedicated signage is proposed for Strokestown House, the Rathcroghan complex (including the visitor interpretation facilities in Tulsk) and the Douglas Hyde Centre. Town signage identifying the presence of service stations, restaurants/cafes and accommodation will be provided for Strokestown and for the smaller communities of Frenchpark, Bellanagare and Elphin. In accordance with the TII manual on tourist and leisure signage, this must be generic in nature except where tourist facilities are of high significance or achieve a threshold of visitor numbers.
3.4	Some of the other mitigation proposed includes: • Traffic Management Plan • Appropriate traffic signals and light sequences

No.	Description
	• Junction improvements • Underpasses and crossings for pedestrians and cyclists • Car park provided for graveyard at Strokestown • Visual and noise mitigation as proposed in other sections

19.4. Mitigation Measures for Biodiversity

No.	Description
4.1	**Watercourses & Culverts** All works in proximity to watercourses shall follow the best practice guidance outlined in the following documents: • TII/NRA 'Guidelines for the crossing of Watercourses During Construction of National Road Schemes (2008); • Shannon Regional Fisheries Board (SRFB) Protection and Conservation of Fisheries Habitat with Particular reference to Road Construction (2009); • Inland Fisheries Ireland requirements publication" Guidelines on protection of fisheries during construction works in and adjacent to waters" (2016) Where a box culvert is required, the invert of the culvert has been set at least 500 mm below the existing bed level, and at the same gradient or near the same gradient as the existing bed. Where necessary, additional works to reduce flow and minimise bank erosion and facilitate passage of fish, such as the installation of baffles or pools and rock armour to protect the banks will be undertaken. Where a pipe culvert is required, the invert of the culvert will be set at least 300mm below the existing bed level, and at the same gradient or near the same gradient as the existing bed. Where necessary, additional works to reduce flow and minimise bank erosion and facilitate passage of fish, such as the installation of baffles or pools and rock armour to protect the banks will be undertaken. The original bed material will be reinstated or where imported will consist of rounded washed gravels which will be either seeded upstream of the culvert or are placed in the culvert before it becomes live. Over-sized culverts have been designed with rock armour training from the inside of the headwalls back to natural channel width to form a low flow channel. Offline culverts will require channel stabilisation works (for all channels) and fisheries development works which will be undertaken in conjunction with Inland Fisheries Ireland (IFI). The screening of temporary or permanent culverts to prevent trash build up can cause an obstruction to fish passage and will not be permitted. ***Diversions*** Where watercourses are to be diverted, dewatering will be required. IFI or a suitably qualified contractor will conduct an electrofishing operation to remove any fish from the channel prior to dewatering. Where a temporary/permanent river diversion is required (e.g. Tributary of Scramoge River), the design, construction and operation of the channel will require the provision of artificial geotextile membrane sheeting or rock armour, on the side and base of the temporary channel. This will minimise erosion and potential surface water runoff. In an effort to reduce the number of culverts and loss of fisheries habitat, the construction of new river channels running parallel to the road sections have been incorporated into the project design (e.g. Diversion of the tributary of the Scramoge River). The new channels shall be constructed in dry conditions. Channels shall also be constructed in a fish friendly manner and constructed in conjunction with IFI. Newly created channels shall incorporate instream structures, features and meanders that will give rise to flow type variation as found in fish bearing waters. The channel base widths have been designed to match the width of the diverted channels.

No.	Description
	All watercourse diversions will be subject to channel stabilization works (lining the new channel with rounded washed gravel to a maximum depth of 300mm below finished bed level and bank scour protection in the form of rock armour along the channel). These works will be undertaken in consultation with IFI. All the planting along these will be with native deciduous trees. There will be no planting within 5 m of the channel. All instream works in watercourses identified as being of fisheries value shall be undertaken during the period July - September in accordance with the IFI Guidelines 2016 unless under previous agreement with the IFI. Main watercourses of fisheries value agreed with IFI: 1. Scramoge/Mountain River 2. Strokestown River Ch. 51+150 3. Upper Owenur River 4. Un-named Stream Ch. 21+325 5. Owennaforeesha River 6. Un-named Stream Ch. 12+700 7. Carricknabraher River 8. Watercourse at Ch. 22+000 9. Watercourse at Ch. 33+250 Mitigation measures to protect watercourse from pollution include: **Earthworks** A Construction Erosion and Sediment Control Plan (Appendix 10.1 of EIAR) has been prepared for the development and the measures outlined in the document shall be strictly adhered to during the construction. The principle avoidance and control measures in relation to earthworks are outlined in Section 5 of Appendix 10.1. **Hydrocarbon usage** • It is likely that all machinery will be refuelled from mobile tankers on the local/access/haul/site roads. No refuelling is to take place within 50m of any watercourse. • Mobile storage such as fuel bowsers will be bunded to 110% capacity to prevent spills. Tanks for bowsers and generators shall be double skinned. • All valves and fuel trigger guns from fuel storage containers will be locked when not in use. • All plant refuelling will take place at mobile fuel bowsers. Only dedicated trained, competent personnel will carry out refuelling operations. Plant refuelling will take place as far as practicable from watercourses and not within 50m in any case. A spill kit and drip tray shall be on site at all times and available for all refuelling operations. Equipment shall not be left unattended during refuelling. All pipework from containers to pump nozzles will have anti-siphon valves fitted. • Strict procedures for plant inspection, maintenance and repairs shall be detailed in the contractor's method statements and machinery shall be checked for leaks before arrival on site. • All site plant will be inspected at the beginning of each day prior to use. Defective plant shall not be used until the defect is satisfactorily fixed. • All major repair and maintenance operations will take place off site. • Care will be taken at all times to avoid contamination of the environment with contaminants other than hydrocarbons, such as uncured concrete or other chemicals. Specific measures to offset potential impacts relating to surface water runoff, during the operation of the road, have been incorporated into the design of the proposed road development.
4.2	**Badger** Mitigation measures to minimise the potential for impacts on badgers are as

No.	Description
	follows (TII/NRA Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes, 2006): *Pre-construction Badger survey* Prior to any works, a pre-construction Badger survey will be undertaken to ensure badgers have not taken up residence within or close to the road footprint. This survey will also confirm whether the disused main and outlier setts that were identified during the dedicated surveys undertaken are still disused or have become active in the intervening period between planning and construction and will confirm if the active setts discovered are still active. *Exclusion of Badgers* Should any active setts be recorded within the development footprint during the pre-construction survey, the procedure outlined below will be followed. Exclusion of Badgers from active setts will only be carried out in the period July to November inclusive in order to avoid the Badger breeding season. Exclusion of Badgers from disused or currently inactive setts may be completed throughout the year. Disused setts (Main and Outlier) have been identified within the footprint of the proposed road development. These setts, at the time of surveying, were considered to be unused by Badgers although one sett was being used by Fox and further survey work will be required to ensure the setts are inactive at the time of construction. In the case of disused setts, initial exclusion involves lightly blocking entrances with vegetation and a light application of soil (i.e. soft blocking). Soft blocking confirms the absence or presence of Badgers. If all entrances remain undisturbed for five days, setts should be destroyed immediately under licence from National Parks and Wildlife Service (NPWS). If it is not possible to destroy the sett immediately, the entrance should be hardblocked using buried fencing material and compacted soil and destroyed as soon as possible. In addition, an active subsidiary Sett was encountered at Scramoge. This was located at the very edge of the land acquisition boundary. Should this sett remain active or further active setts be encountered prior to construction, TII/NRA Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes, 2006 will be followed for the exclusion of active setts. The zone of influence for Badger setts as a result of construction works is 150 m where pile driving may occur or, where there is no requirement for pile driving, within 50 m of an active sett during breeding season or within 30 m outside of breeding season (NRA, 2006). Active Badger setts have been identified at 60, 80 and 90 metres from the proposed road development footprint. As a result, it may be essential to temporarily exclude Badgers in these areas should pile driving be required during construction. Exclusion of Badgers from active setts is best avoided during the breeding season as cubs may remain underground after all adults have been excluded. Inactive sett entrances should be soft-blocked then hard-blocked and the sett destroyed as soon as possible, under the supervision a licensee (TII/NRA, 2006). One-way gates should be installed on active entrances to allow badgers to exit but not re-enter. These gates should be tied open for three days prior to being set. Once gates have been installed, they should be left in place whilst works are conducted within the zone of influence. If the gates are left in place for long periods of time Badgers may attempt to dig around them or to create new entrances. Therefore, the gates should be in place for the minimum time necessary and should be inspected regularly for signs of disturbance. *Badger Underpasses* Badger underpasses are included in areas of identified badger activity to reduce impacts on Badger communities in the area as a result of the operational phase of the proposed road development.

Number	Chainage	Number	Chainage
1	10+130	8	17+250
2	11+700	9	17+400

No.	Description

3	12+700	10	21+325
4	14+150	11	30+750
5	14+540	12	51+110
6	14+600	13	52+830
7	15+210	14	52+900

Note: Table includes both badger and otter crossings.

Badger underpasses are usually constructed of 600mm concrete pipes but may form part of a watercourse culvert or bridge, where appropriate. Regard should be had to TII Standard Construction Detail (SCD) CC-SCD-02504 and CC-SCD-02505. Badgers must be guided into the underpass by mesh fencing. The fencing design shall be in accordance with CC-SCD-00319.

Underpasses will be sited as close as possible to existing Badger paths and should follow existing wildlife corridors such as hedgerows. The underpasses and fencing should be installed at the earliest stage possible during the construction phase so as to encourage Badger use. Where it is unfeasible to create a Badger underpass due to engineering constraints, it will be moved to a more suitable location not more than 250 m from the original location and guide planting and fencing will be provided. Having regard to SCDs the following measures, as per TII/NRA (2006) will be adhered to when constructing the prescribed Badger underpasses:

- Exit and entrance to tunnels should be flush with badger-proof fencing;
- Drainage will be adequate to prevent waterlogging at entrances and within underpass;
- Where stream culverts are being installed, structures greater than 1 m diameter should be fitted with a raised mammal ledge, elevated above normal flood levels. Alternatively, a separate pipe culvert (600mm) can be set above flood level adjacent to the culvert; and,
- The entrances to the underpass may be planted with appropriate hedgerow planting to encourage Badger use though this should not obscure the entrances.

Mammal-Resistant Fencing

Fencing is required to prevent Badgers from crossing road points other than at underpasses. The fencing must extend a sufficient distance to ensure that Badgers will not find an easy way around. Underpass entrances will be recessed in fence lines, thereby guiding animals to them.

The extent of fencing has been determined by the locations at which Badgers are likely to encounter the road development and the frequency with which they may attempt to cross the proposed road development. It will be installed in all areas where Badger signs were recorded and will extend to cover the foraging habitats surrounding the recorded signs. Badger-proof fencing will not be installed asymmetrically and will be installed in parallel on both sides of the road and care will be taken to avoid any gaps or weaknesses even at awkward features such as undulating ground or streams in accordance with CC-SCD-00319.

4.3 **Otter**

Pre-construction Otter survey & Exclusion

Prior to any works, a pre-construction Otter survey will be undertaken to ensure that Otter have not taken up residence within or close to the road footprint. Should any holt be encountered during the pre-construction surveys, it will be subject to exclusion procedures as outlined in the TII/NRA guidelines (2006).

Treatment of Otters at Watercourse crossings

The welfare of Otters will be ensured primarily through the provision of continued safe access for Otters to their ranges and foraging habitats. Adequate provision for Otters at affected watercourse crossings is required to allow the species to retain continued access to their foraging areas.

Ledges or underpasses will be required at all watercourse crossings on the

No.	Description
	proposed road development. Where ledges cannot be installed, provisions for commuting Otter in the form of underpasses which may be utilised by other species including Badgers must be provided. Where Badger-resistant fencing has been recommended to restrict movement of Badgers across roads, this will also prevent Otter movement across the road carriageway. Mitigation measures at smaller water crossings may include the provision of box culverts with ledges rather than pipe culverts. *Ledges at Water Crossings* Ledges must be at least 500mm wide and constructed above the 1 in 5 year flood event and allow at least 600mm headroom (TII/NRA, 2006). Such ledges are typically constructed of solid concrete on one or both sides of a bridge or culvert but may be constructed of wood or metal bolted to the structures sides. Ledges on both sides of a watercrossing are recommended however should this not be feasible, one ledge may suffice. Adequate access to ledges from the banks of the watercourse must be ensured. Additionally, ledges may be provided traversing waterbodies to allow animals to cross from either side to facilitate use of a single ledge culvert. Ledges will be linked to other wildlife corridors so as to ensure their functionality and use by faunal species. *Underpasses* Where it is not possible to provide a ledge or larger culvert, an underpass next to the watercourse may be provided. Underpasses, where constructed, will be composed of 600mm diameter concrete pipes. Ramps will be provided to ensure accessibility, if required. Underpasses should be as short as possible and daylight should be visible through the tunnel. Drainage will prevent waterlogging at entrances and throughout the underpass. The tunnels will be sited as close as possible to watercourses and guiding features such as mammal-proof fencing, walls or natural features such as hedgerows will be installed to guide Otters and other fauna towards the underpass. *Mammal Fencing* Mammal-resistant fencing (as per CC-SCD-00319) has been incorporated in parallel on either side of all water crossings. This fencing will extend to greater than 50 metres. *Maintenance of Riparian Cover* Where possible, riparian cover will be restored using the same native species as soon as practicable following construction works. Access to ledges and underpasses will be provided by appropriate levelling to ensure use of such structures by animals. Planting will not obstruct wildlife underpasses or walkways in the short or long-term. *Post-Construction Monitoring and Mitigation (NRA 2006)* As per TII/NRA guidelines (2006), post-construction maintenance of Otter underpasses and monitoring of mitigation measures will be conducted at quarterly intervals over a period of a year following construction. Any deficiencies in the measures implemented should be reported to relevant authorities and corrected where possible.
4.4	**Bats** The guidance followed for mitigation measures for Bats is • '*Guidelines for the treatment of bats during the construction of National Road Schemes'* (TII/NRA, 2006) • *'Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes'* (TII/NRA 2005) • *'Irish Wildlife Manual No. 25 published by NPWS 'Bats Mitigation Guidelines for Ireland'* (Kelleher & Marnell, 2006). *Tree-felling and Hedgerow Removal* Habitats and key areas important for commuting and foraging Bat species have been avoided much as possible as part of the route selection process. Hedgerows

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	and treelines to be lost during construction will largely be replaced as part of the landscaping plan. The proposed road development involves specific prescriptions for tree planting to ensure that habitat connectivity is not severed by the proposed road. Proposals include: • Tree planting to provide commuting habitat along the proposed road and to guide Bats to other linking tree lines/hedges, woodland, bridges, culverts or underpasses that may be used to cross the road. A network of vegetation around the proposed road in many sections of the study corridor will provide additional biodiversity within the landscape. • Planting of riparian trees to allow continued use of river corridors. • Planting of tall (semi-mature) trees on opposite sides of the road at particular locations where connectivity is severed to provide Bat flyovers (or hop-overs). This planting is done in association with strong guiding tree lines on both sides of the road to provide a safe crossing point for bats. • Planting will utilize native species as these have a greater range of insects associated with them that provide an additional source of food for bat species. Pre-construction Bat surveys will be required by suitably qualified Bat ecologists prior to any felling, particularly in the vicinity of Corry West, Corry East, Tullyloyd, Bumlin and Scramoge where particularly well developed networks of tree lines were recorded. In addition, the proposed road passes close to known and identified roost sites at Scramoge and surveys of mature trees in this area will also be undertaken. If the presence of roosting Bats in a tree is suspected, a close up inspection by a suitably trained ecologist is required prior to felling. Should any tree roosts be identified, a derogation licence from NPWS will be required to fell these trees. When felling mature trees in areas that have been identified as having higher potential for roosting bats within trees, the following TII/NRA (2006b) requirements will be followed: • Immediately prior to felling, mature trees with a high potential to support roosting bats will be inspected for the presence of Bats and/or other Bat activity by a suitably qualified Bat ecologist during daylight hours and night-time using a bat detector. This survey will be carried out from dusk through the night until dawn to ensure bats do not re-enter the tree; • Where examination of the tree has shown that Bats have not emerged or returned to a tree, felling may proceed the following day. Should a delay of one day or greater in felling be encountered, resurveying is required; • Felling during winter months (November – March) will be avoided as this increases risk to hibernating Bats. If there is a requirement to fell trees in these sensitive areas during this period, any trees with significant roosting features will be subject to a detailed inspection undertaken by a suitably qualified professional. *Lighting* It is proposed to provide external lighting installations at the five proposed roundabout locations. The external lighting is designed to approved standards that minimise light spillage and thus reduce the impact on areas outside and on the boundaries of the development footprint and consequently on bats. The luminaries will be horizontally mounted and will be fitted with double asymmetric flat glass luminaries of the full cut off type that prevent upward spillage of light and minimise horizontal spillage away from the intended lands. No artificial lighting is proposed within or adjacent to habitats of significance for Bat species. However, to avoid the potential for any such impact it will be ensured that no lighting is focused onto areas of ecological sensitivity such as tree lines or watercourses and that lighting design provides for low levels of lateral light spillage to avoid unwanted areas of illumination. *Buildings* Identified roosting sites will not be directly impacted upon by the proposed road

No.	Description
	development. The building to be demolished at Corry East does not currently support roosting Bats. This building will be subject to pre-construction survey (as per TII/NRA, 2005b) prior to demolition to ensure Bats have not taken up residence. If bats are found to be present, exclusion measures will be followed under licence from the NPWS.
4.5	**Birds** *Breeding birds* The landscaping plan involves the planting of hedgerow, tree line and woodland habitat, which will mitigate the loss of nesting bird habitat and has the potential to result in a positive impact in some areas along the study corridor. *Wintering Birds* To offset any potential impacts on wintering birds at the embankment location, the landscape plan incorporates a tree line of semi-mature trees along the south of the proposed embankment, encouraging birds to increase their flight height and fly over the road, reducing the potential for collision. The treeline would also act as a visual/sound barrier, reducing potential disturbance/displacement related impacts.
4.6	**Invasive Species** An IAS Management Plan will be prepared in relation to the treatment of the identified stand of Knotweed at 51+250 in accordance with the following guidance: • National Roads Authority TII/NRA (2010). Guidelines on management of noxious weeds and non-native invasive plant species on national roads. • Environment Agency (UK) (2013). The Knotweed Code of Practice: Managing Japanese Knotweed on Development Sites (Version 3, amended in 2013). Prior to any works being carried out, a pre-construction invasive species survey will be undertaken to ensure that additional invasive have not been introduced to areas within or close to the road footprint. The following measures address potential impacts associated with the construction phase of the project: • Good construction site hygiene will be employed to prevent the introduction and spread of problematic invasive alien plant species (e.g. Himalayan Balsam, Japanese Knotweed etc.) by thoroughly washing vehicles prior to leaving the site. • All plant and equipment employed on the construction site (e.g. excavator, footwear, etc.) will be thoroughly cleaned down using a power washer unit prior to arrival on site to prevent the spread of invasive plant species • All washing must be undertaken in areas with no potential to result in the spread of invasive species. This process will be detailed in the contractor's method statement. • Any soil and topsoil required on the site will be sourced from a stock that has been screened for the presence of any invasive species and where it is confirmed that none are present. • All planting and landscaping associated with the proposed development shall avoid the use on invasive shrubs such as Rhododendron.

19.5. Mitigation Measures for Soils & Geology

No.	Description
5.1	Mitigation of geological impacts during operational phase will be in relation to slope stability issues identified during construction. The mitigation will include the appropriate design of gabions, soil nailing and structural retention systems. The areas will be monitored to ensure the measures in place suitably mitigate the risk of slope failure.
5.2	Where slopes become unstable due to high groundwater table and inflow during

No.	Description
	construction, pumping locations shall be constructed in order to drain the water table below the level of the granular material and/or cut level for the duration of the construction and the slope stability shall be monitored. Long term gravity drainage measures will be employed to retain the groundwater levels below the road level.
5.3	Based on the findings of the ground investigation it is not likely that construction dewatering will be required in any potential karst areas. In areas of karstification it is important to note that any change in the normal groundwater patterns may cause potential instabilities. If any of these occurrences arise during construction the following measures will be carried out • Carry out detailed stability assessments to assess the need for basal reinforcement • Provide sealed drainage systems; or • Provide liners to prevent changes in groundwater levels and patterns.
5.4	Seepage from slopes in glacial till shall be mitigated by the use of an appropriate drainage system such as herringbone drains or counterfort drains on the slope surface with suitable angles employed to maintain slope stability.
5.5	If local sections of the rock slopes are not stable at steeper slope angles the slopes can be stabilised using rock anchors, netting and shotcrete. Rock traps can be provided as a further mitigation against localised instability of discrete rock blocks. Benching of the cut slopes to permit maintenance access and as a mitigation against slope erosion due to drainage will be required.
5.6	The area between Ch 18+400m and 19+300m is noted as being an area of karstification with a number of swallow holes present at the ground surface level, one of which occurs within the proposed road footprint at Ch 19+050m. It may be required that an impervious liner is put in place beneath the road construction to prevent permanent impacts of surface drainage flowing into exposed bedrock within this area if rock is encountered above the proposed finished road level.
5.7	Importation of materials from outside the site will be minimised by ensuring that materials arising within the site are used to the greatest extent possible. Where necessary naturally occurring materials will be processed to reduce moisture content and/or improve grading in order to maximise suitability for re-use.
5.8	Inevitably materials will be encountered which cannot practically be processed into usable fill material. These materials are generally suitable for landscaping and therefore will be used within the site boundary as Class 4 material or deposited in Material Deposition Areas. It is anticipated that the contractor appointed to construct the road project will optimise the use of ground improvement, piled embankments and soil improvement for re-use either in general fill or landscaping to eliminate the need for material to be disposed of off-site.
5.9	If encountered, contaminated soils will be excavated and disposed off site in accordance with the Waste Management Act, 1996, as amended, and associated regulations and guidance provided in the NRA's Guidelines for the Management of Waste from National Road Construction Projects (National Roads Authority 2008).
5.10	Peat, alluvium, lacustrine deposits and other unacceptable material will be stored in defined areas known as material deposition areas adjoining to or in close proximity to the proposed road development and will be contained within engineered bunds. In areas where deep deposits occur, consideration can be given to the following ground improvement solutions: • Partial Excavate and replace (Removal of Peat / organic soils only) • Basal Reinforced Earthworks • Vertical drainage Measures in combination with Surcharge Loading (Not suitable in peat) • Pile Supported load Transfer Platforms
5.11	Material deposition areas will be enclosed within double erosion control fencing

No.	Description
	(silt fence) and erosion control features installed at the drainage outfalls of the sites prior to works being undertaken. Where required, an access road will then be constructed within the material recovery area together with wheel wash facilities. Materials will initially be delivered to the working area for access road and perimeter berm construction by low ground pressure vehicles such as tracked dumpers and light weight, wide track excavators.
5.12	At Portaghard (Ch 3+450m) a number of surface karst drainage features were identified at this location. A sealed drainage system for road drainage is proposed between Ch.4+000 to 4+250 to protect groundwater. A drainage layer is proposed beneath the road at Ch.4+000 to maintain the existing surface drainage patterns.
5.13	At Kilvoy and Corry East (Ch 18+400m – 19+300m) a number of swallow holes were identified within close proximity to the proposed route, with one swallow hole being located within the footprint of the proposed route. Approximate dimensions of the surface depressions are 1 – 2m in diameter. Basal reinforcement will be required in this area to ensure stability of the proposed road and to span across the karst feature located within the footprint of the proposed route. Soft ground or voids present at these locations will be initially excavated and backfilled with Class 6A or 6C fill to maintain the current drainage function which such depressions may serve to surrounding lands. A sealed drainage system will be required for the road drainage in this area. Also, roadway drainage ditches, swales and ponds will be located away from embankments within these specific locations to avoid increasing the flow rates and risks of soil erosion or collapse. Existing and intercepted overland and interflow from cut-off ditches within this area will be directed to the swallow hole to maintain existing recharge. Similar measures are anticipated from Ch 20+350m to 20+550m in the vicinity of the observed karst feature at Ch 20+450m.
5.14	At the Carricknabraher River Bridge at Ch 10+150m and at the Scramoge River at Ch 52+840m bridge foundations at will require piles founded at depths in bedrock below horizons of highly weathered and voided karstified rock.

19.6. Mitigation Measures for Hydrogeology

No.	Description
6.1	Avoidance, control and mitigation measures described in the Construction Erosion and Sediment Control Plan will be implemented in full.
6.2	The following mitigation will be incorporated in respect of groundwater supplies: • All groundwater supplies currently in use that are within the footprint of the proposed road development will be replaced either through the provision of a private supply or by providing a connection to an existing public or group water scheme; • All groundwater supplies currently in use that are up to 150m from the development boundary or 50m beyond the zone of influence of cuttings will be monitored (for water level and quality) immediately prior to the commencement of construction activities, during on a regular basis and for a time (typically monthly for 12 months) after construction. Monitoring of any private supplies is subject to agreement by the relevant land/ property owner. Should it be concluded that any of these monitored private supplies be lost or contaminated as a result of the development, these shall be replaced either through the provision of a private supply or by providing a connection to an existing public or group water scheme;
6.3	Where significant groundwater flows are encountered in deep bedrock cut sections, mitigation will be provided to ensure the continued flow of same where possible. The mitigation may involve either piping, construction of gravel filled pathways or short diversions

No.	Description
6.4	Any hydrocarbon leakages or spillages during construction will be dealt with immediately, according to the procedures set out in the CESCP.
6.5	Imported fill shall be in accordance with the requirements of the NRA/TII Specification for Road Works. Where water supply wells and springs are located underneath the proposed road development footprint, these will be sealed to prevent contaminants entering the aquifer (Well Drilling Guidelines (IGI, 2007)).
6.6	Prior to the commencement of construction works, clean runoff water from lands adjacent to and up gradient of the works area will be diverted to local watercourses through the installation of cut-off ditches. Soiled construction runoff water will undergo treatment before discharge by being passed through a settlement pond. The treated water may be discharged to a surface water body, but depending on drainage features may also discharge to ground (i.e. Mantua, Cregga Turlough) so as to maintain the existing recharge conditions.
6.7	Throughout the proposed road development in areas of extreme and high vulnerability and near sensitive ecological receptors, a sealed drainage system will be used. Locations are provided in Table 9.29 of Chapter 9.
6.8	Wetland systems will be provided at all outfalls to protect both surface and groundwater from any adverse quality and/or quantity impacts of the road drainage discharge.
6.9	Hydrological Features Wetland and Ecologically Sensitive Areas- The adherence to best practise construction methods shall ensure that dewatering does not occur to these sensitive areas. In addition the practices set out in the CESCP will ensure that soiled constructional runoff waters do not enter these areas. • At deep cut sections such as Killeen East (32+100 to 33+100) and Cregga Hill (35+600 to 37+600) the adherence to best practise construction methods shall ensure that the correct management of surface water runoff occurs. A separate filter drain / cut-off channel will be provided to collect and drain intercepted groundwater and interflow to nearby watercourses. • The swallow-hole, enclosed depressions and associated karstified bedrock located at Leggatinty are required to be protected from contamination by surface water runoff. A double silt fence will be constructed along the site boundary so as to intercept and minimise the potential direct runoff from the works area to the adjacent swallow holes and watercourses. No untreated temporary discharge from the construction runoff will be permitted to the swallow holes at this location. • A double silt fence will be constructed along the site boundary of blanket bogs and wet grassland areas (Molina Meadows) so as to intercept and minimise the potential direct runoff from the works area to the adjacent wetland areas (See Figures in Appendix 10.1 CESCP). No untreated temporary discharge from the construction runoff will be permitted to discharge to watercourses. Existing drainage paths along these wetland systems will be preserved by the inclusion of shallow drains with check dams to retain high water levels, culverting watercourses appropriately and, to prevent drainage effects of the road formation, the provision of impervious subsurface liners either in a transverse or longitudinal configuration (See Figures in Appendix 10.1 CESCP). In areas of bog, a longitudinal impermeable geotextile barrier will be installed along the edge of the road formation face to prevent /block the draining of the peat. In wetland areas (such as the Molina meadows), a transverse impermeable barrier is provided at intervals to prevent the road formation draining adjacent wetland areas (see Section 19.7, measure 7.6 of this report for chainages). • The fen at Tullyloyd will be mitigated by means of a double silt fence constructed along the site boundary so as to intercept and minimise the potential direct runoff from the works area to the adjacent wetland areas (See

<table>
<tr><th>No.</th><th>Description</th></tr>
<tr><td></td><td>Figures in Appendix 10.1 CESCP).. No untreated temporary discharge from the construction runoff will be permitted to discharge to watercourses. Between Ch. 33+400 and Ch. 34+000 a drainage blanket will be provided to allow flow to pass beneath the road formation so as not to affect the existing seepages present within the Fen. Transverse barriers will also be provided within the road formation every 100m to block drainage away from the area in the permeable road formation layer. Existing transverse flow paths/ditches will be maintained while a sealed road drainage system is proposed in this area which will be attenuated and treated in a two stage treatment pond.
• Mitigation measures for the swallow hole and karst features at Mantua will include a double silt fence constructed along the site boundary so as to intercept and minimise the potential direct runoff from the works area. Existing and intercepted overland and interflow from the cut-off ditches will be directed to the swallow hole to maintain existing recharge. Cut-off drains on the southern side of the alignment between Ch.18+500 and Ch.19+100 discharge via a drainage pipe at Ch. 18+500 beneath the carriageway to the swallow hole. Transverse barriers will also be provided within the road formation every 100m between Ch. 18+800 and 19+300 to block drainage away from the area in the permeable road formation layer to mitigate the risk of flooding. (See Figures in Appendix 10.1 CESCP).
• Interceptor drains will be incorporated at Cregga Turlough to capture hill slope runoff (overland and shallow interflow) as well as deeper percolating groundwater flow. These drains will be connected to Cregga Turlough through the use of suitable drainage channels and a permeable distribution area provided underneath the alignment in this location.</td></tr>
<tr><td>6.10</td><td>Proposed Mitigation Measures for Hydrological Features
<table>
<tr><th>Site Name</th><th>Stage</th><th>Mitigation Measure</th></tr>
<tr><td>Leggatinty swallow holes, Caves and karst features Ch 10+000 to 14+000</td><td>Construction</td><td>A CESCP has been developed which the contractor will be contractually bound to adhere to. This plan will ensure flows to the stream will be maintained through culverting (refer to Chapter 10) temporary works and diversions and that there is no appreciable deterioration in water quality</td></tr>
<tr><td rowspan="2">Peak-Mantua Spring Supply Ch 15+900</td><td>Construction</td><td>The implementation of the CESCP will ensure no construction related impacts to the Peak-Mantua spring supply. This will include silt fences erected on or inside the development boundary which together with the fenceline will restrict construction activity in the vicinity of the zone of contribution and inhibit silt or sediment material from moving southwards into the ZOC and entering the recharge zone. No works will take place outside the land acquisition boundary and therefore works within the ZOC will not be permitted.</td></tr>
<tr><td>Operational</td><td>The design will ensure surface and groundwater flows in the area are maintained largely intact. Streams will be maintained through culverting (Refer to Chapter 10) and diversions. The road is not in cut at this point and will stay outside the ZOC for the spring supply. This will ensure that there is no appreciable change in recharge/discharge to the spring supply.</td></tr>
</table></td></tr>
</table>

No.	Description		
	Polecat Spring Supply ZOC – (Polloween swallow hole) Ch 17+750 – 32+750	Construction	The implementation of the CESCP will ensure no construction related impacts to the Polloween swallow hole (which is connected to the Polecat spring supply). This will include silt fences which will restrict construction activity in the vicinity of the zone of contribution. In addition, interception ditches (cut-off ditches) will be constructed in advance of the main ground works which will redirect overland flow into the swallow hole and maintain its current recharge regime.
		Operation	The design will ensure surface and groundwater flows in the area are maintained largely intact. Interception ditches will be constructed in advance of the main ground works which will redirect overland flow into the swallow hole and maintain its current recharge regime. This will ensure that there is no appreciable change in recharge/discharge to the spring supply.
	Kilvoy and Corry East swallow hole and karst features Ch 18+400 to 19+300	Construction	The proposed road development has been routed away from these karst features, however stormwater drainage, which would have previously entered the area as overland flow, will be collected and conveyed away from karst areas. The CESCP and the measures outlined in Chapter 10 for overland and stream flow diversions will ensure that any reductions in flow to the feature are not appreciable.
		Operation	Cut-off drains from the north and south of the alignment will be directed to a drainage pipe at Ch.18+500 which will discharge to the swallow hole. In addition two transverse barriers will be incorporated beneath the road to the east to mitigate the flood risk to the road at the base of the cutting. Basal reinforcement (Ch. 18+450 – Ch. 19+300 & Ch. 20+350 – Ch. 20+550 combined with a drainage layer (Ch 18+400 – Ch. 19+300m) to maintain existing drainage patterns has been incorporated into the road construction design at this location.
	Ovaun Stream Swallow hole feature Ch 34+400	Construction	The construction works will not take place within 100m of this feature. The CESCP will ensure that construction works do not impact on this feature. All site drainage is being routed through an attenuation pond which is to be constructed in advance of any works and will provide treatment prior to discharge. In addition the CESCP will ensure that construction works do not impact on this feature.
		Operation	An assessment of flows in the Ovaun has shown that only a small proportion enters groundwater through the swallow hole feature. This occurs some 150m downstream of where the road drainage outfall is located. The road

No.	Description		
			drainage will be treated to a high standard in an attenuation pond with a treatment forebay and penstock provided prior to this outfall point. Given the low level of contaminants anticipated and the treatment measures involved the risk to groundwater is very low.
	Cregga Turlough Ch 36+650 to Ch 37+90	Construction	A CESCP has been developed and will be implemented by the contractor. Construction sequencing has been developed to avoid sediment laden waters entering the Turlough. Refer to the CESCP in Appendix 10.1 for full details. The measures outlined in the CESCP will ensure contaminated waters do not enter the Turlough.
		Operation	All overland flow and flows arising from the rock cut face will be directed into infiltration galleries located between Ch.36+500 to Ch.36+700, Ch.37+670 to Ch.37+870 and Ch.38+030 to 38+130. This will ensure that all natural overland flow to the Turlough will be largely maintained with no appreciable change.
6.11	Should the presence of karst features be encountered during the earthworks. the road construction may require basal reinforcement or similar mitigation measures.		
6.12	A routine groundwater monitoring programme will be established to monitor water levels of all public and private groundwater supplies that are up to 150m from the development boundary or 50m beyond the zone of influence of cuttings. This will involve these supplies being monitored (for water level and quality) immediately prior to the commencement of construction activities, during on a regular basis and for a time (typically monthly for 12 months) after construction so that any impacts during the construction phase can be identified.		
6.13	Where low yielding wells have to be replaced or where the source of any contamination of water supplies cannot be identified or mitigation of same is either not possible or not financially viable; an alternate water supply will be provided either by a replacement well or by establishing a connection to alternative water supplies (i.e. connection to a regional/group water supply scheme).		
6.14	Attenuation ponds will be lined with cohesive material, with the addition of an engineered liner where a sealed drainage system is in use, and outlet by infiltration will not be permitted. The treatment forebay and main attenuation area will be lined as above and suitably planted to promote the removal of contaminants. A penstock is also provided at the outlet so that in the event of an accidental spillage entering the pond, the outlet can be closed and the contaminant removed by pumping.		

19.7. Mitigation Measures for Hydrology

No.	Description
7.1	Avoidance, control and mitigation measures described in the Construction Erosion and Sediment Control Plan will be implemented in full. An Environmental Operating Plan (EOP) will be prepared for the proposed road development and will incorporate an Emergency Response Plan. Requirements for The use of filter drains, sealed drainage systems and vegetated lined wetland system upstream of all road drainage outfalls are proposed to incorporate a range of pollution control features within the drainage system to limit the water quality

No.	Description
	impact to receiving waters. The use of sealed drainage systems in areas of high and extreme groundwater vulnerability and adjacent to sensitive wetland areas to collect and convey the road drainage runoff water shall be implemented. Locations are provided in Table 9.29 of Chapter 9. The use of temporary and permanent settlement and attenuation ponds shall be incorporated prior to discharging water to receiving watercourses to restrict sediment laden or polluted waters causing downstream deterioration in water quality.
7.2	**Principle Construction Mitigation Measures** • All constructional compound areas will be required to be set back a minimum of 10m from river and stream channels and out of potential floodplain areas. • Surface water flowing onto the construction area will be minimised through the provision of berms, diversion channels and cut-off ditches. • Management of excess material stockpiles to prevent siltation of watercourse systems through runoff during rainstorms will be undertaken. This may involve allowing the establishment of vegetation on the exposed soil and the diversion of runoff water off these stockpiles to the construction settlement ponds. • Where constructional works are carried out adjacent to turloughs, fens, stream and river channels and lakes protection of such waterbodies from silt load shall be carried out through use of grassed buffer areas, timber fencing with silt fences or earthen berms to provide adequate treatments of runoff and constructional site runoff waters to the watercourses. • Use of settlement ponds, silt traps and bunds and minimising construction within watercourses. Where pumping of water is to be carried out, filters will be used at intake points and discharge will be through a sediment trap. • All watercourses that occur in areas of land that will be used for site compound/storage facilities will be fenced off at a minimum distance of 5m. In addition, measures will be implemented to ensure that silt laden or contaminated surface water runoff from the compound does not discharge directly to the watercourse. Compounds shall not be constructed on lands designated as Flood Zone A or B in accordance with the OPW Flood Risk Management Guidelines (November 2009). Compounds will not be permitted in or within 100 metres of a European Site. • The storage of oils, fuel, chemicals and hydraulic fluids will be in secure areas within the site compounds and will not occur within a minimum of 10m from watercourses. Storage tanks shall have secondary containment provided by means of an above ground bund to capture any oil leakage. Storage tanks and associated provision, including bunds, will conform to the current best practice for oil storage and will be undertaken in accordance with *Best Practice Guide BPGCS005 – Oil Storage Guidelines* (Enterprise Ireland). • Foul drainage from all site offices and construction facilities will be taken off-site and disposed of by a licensed contractor in accordance with legislation to prevent pollution of rivers and local water supply. • The construction discharge will be treated such that it will not reduce the environmental quality standard of the receiving watercourses. • Riparian vegetation along the identified sensitive watercourse will be fenced off to provide a buffer zone for its protection to a minimum distance of 5m with the exception of proposed crossing points • Any surface water abstracted from a river for use during construction shall be through a pump fitted with a filter to prevent intake of fish. • The use and management of concrete in or close to watercourses will be carefully controlled to avoid spillage which as stated earlier has a deleterious effect on water chemistry and aquatic habitats and species. Alternate

<table>
<tr><th>No.</th><th>Description</th></tr>
<tr><td></td><td>construction methods are encouraged for example, use of pre-cast or permanent formwork will reduce the amount of in-situ concreting required. Where on-site batching is proposed this activity will be carried out well away from watercourses. Washout from such mixing plant will be carried out only in a designated contained impermeable area.</td></tr>
<tr><td>7.3</td><td>Water Quality
Road pavement surface water runoff will be collected via sealed drainage systems in sensitive areas as identified in Table 9.29 and discharged to receiving waters via a controlled linear wetland to provide treatment for the runoff.
In all other areas the road drainage shall be collected in an appropriate manner which does not incorporate infiltration and discharge to ground and discharged to receiving waters via a controlled linear wetland to provide treatment for the runoff.
To facilitate an emergency response to any serious spillages, all pond and storage systems will be fitted with a manual penstock so as to close off the outfall and contain the spillage water within the pond/storage system for pumping out and appropriate treatment and disposal.
Storm Water Runoff will accumulate in attenuation ponds, providing a dual function of attenuation and primary water quality treatment.</td></tr>
<tr><td>7.4</td><td>The design and construction of all culvert and bridge structures shall:-
Prevent impact to river morphology and impoundment or alteration of surface water flow hydrodynamics;
Have obtained OPW consent under Section 50 of The Arterial Drainage Act; and
Maintain or improve on provisions for aquatic and mammalian species migration.
Diversion works are described in Section 10.5 of the EIAR and in the Construction Erosion and Sediment Control Plan and same shall be implement in full.</td></tr>
<tr><td>7.5</td><td>Wetland Areas
The mitigation measures outlined in the following table shall be implemented in full for the identified wetland areas.
In areas of wetland or sensitive ecology no improvements shall be made to drains in the surrounding area to ensure that dewatering does not take place.
Additional culverts are provided beneath the road to ensure overland flow connectivity to wetlands and that dewatering does not take place.
Check dams shall be incorporated in shallow toe drains to maintain water levels in the wetlands.</td></tr>
<tr><td>7.6</td><td>Proposed Mitigation Measures for Hydrological Features</td></tr>
</table>

KER Receptor No.	Receptor Name and importance	Stage	Mitigation Measures Proposed
1a(N) & 1B(C) Ch 4+000 to Ch 4+500	Wet Grassland (Molina Meadows) National Importance & County Importance	Operational	No Improvements to drains in the area surrounding the wetland area. Transverse barriers at 100m intervals. Additional culvert beneath the road to ensure overland flow connectivity to wetlands. Check dams to be incorporated in toe drains to maintain water levels in the wetlands.

No.	Description

KER Receptor No.	Receptor Name and importance	Stage	Mitigation Measures Proposed
2a(LH) & 2b(N) Ch 5+000 to Ch 5+500	Degraded and intact Raised Bog and Cutover bog National Importance & Local Importance (Higher Value)	Operational	Longitudinal barrier in the road formation returned to competent bedrock/overburden to prevent the migration of water into road formation. The proposed bog access road shall be of floating road construction with existing drainage channels maintained and thus drainage of the bog will be negligible.
3(LH) Ch 10+125 to Ch 10+150	Carricknabraher River Local Importance (Higher Value)	Construction	A Construction Erosion and Sediment Control Plan (CSECP) has been. The measures outlined in the CSECP will ensure no adverse impacts on water quality occur.
		Operational	Road drainage will be treated in an attenuation pond with a treatment forebay provided prior to outfalling to the receiving watercourse. The attenuation pond will be fitted with a penstock or similar restriction at the outfall to the receiving channel.
4(C) Ch.10+750 to Ch.10+850	Wet Grassland (Molinia Meadows) County Importance	Operational	All existing watercourses and local drainage channels will be maintained to ensure increased drainage of lands does not occur. Transverse barriers at 100m intervals. Check dams to be incorporated on toe drains to maintain wet conditions.
5(N) Ch 11+480 to Ch 12+150	Wet Grassland (Molina Meadows) National Importance	Operational	All existing watercourses and local drainage channels will be maintained to ensure increased drainage of lands does not occur. Transverse barriers at 100m intervals. Check dams to be incorporated on toe drains to maintain wet conditions.
6(a)(N), 6b(N), 6b(C), 6b(LH), 6c(N), 6c(LH), 6c(LL) Ch 10+900 to Ch 12+450	Peatland complex of Raised Bog and Cutover Bog with Wet Heath & Bog woodland National Importance, County Importance & Local Importance (Higher & Lower Value)	Construction	A Construction Sediment Erosion and Control Plan (CSECP) has been developed – see Appendix 10.1. The measures outlined in the CSECP will ensure no adverse impacts on water quality occur.
		Operational	Longitudinal barrier running along the edge of the road formation face. Maintain transverse flow paths/ditches through culverting/piping. Use of shallow toe drains with check dams as appropriate.
7a(N) & 7b(LH) Ch 13+950 to Ch 14+450	Peatland complex of Raised Bog and Cutover Bog with Bog woodland. National Importance & Local Importance (Higher Value)	Construction	A Construction Sediment Erosion and Control Plan (CSECP) has been developed – see Appendix 10.1. The measures outlined in the CSECP will ensure no adverse impacts on water quality occur.
		Operational	Longitudinal & transverse drains. Check dams on toe drains to maintain wet conditions.

No.	Description

KER Receptor No.	Receptor Name and importance	Stage	Mitigation Measures Proposed
8 (LH) Ch 14+450 to Ch 14+800	Owennaforeesha River Local Importance (Higher Value)	Construction	A Construction Sediment Erosion and Control Plan (CSECP) has been developed – see Appendix 10.1. The measures outlined in the CSECP will ensure no adverse impacts on water quality occur.
		Operational	Road drainage will be treated in an attenuation pond with a treatment forebay provided prior to outfalling to receiving watercourse. The attenuation pond will be fitted with a penstock or similar restriction at the outfall to the receiving channel.
			All existing watercourses and local drainage channels will be maintained to ensure drainage of lands does not occur.
13 (LH) Ch 30+550 to Ch 31+950	Upper Owenur River Marsh and Wet Grassland, Wet Grassland Reedswamp & Poor Fen Local Importance (Higher Value)	Construction	A Construction Sediment Erosion and Control Plan (CSECP) has been developed – see Appendix 10.1. The measures outlined in the CSECP will ensure no adverse impacts on water quality occur.
		Operational	Road drainage will be treated in an attenuation pond with a treatment forebay provided prior to outfalling to receiving watercourse. The attenuation pond will be fitted with a penstock or similar restriction at the outfall to the receiving channel.
15a(LH), 15b(LL) Ch 33+350 to Ch 34+350	Lough Clooncullaan and surrounding wetland complex Local Importance (Higher & lower Value)	Construction	A Construction Sediment Erosion and Control Plan (CSECP) has been developed – see Appendix 10.1. The measures outlined in the CSECP will ensure no adverse impacts on water quality occur.
		Operational	Road drainage will be treated in an attenuation pond with a treatment forebay provided prior to outfalling to the receiving watercourse. The attenuation pond will be fitted with a penstock or similar restriction at the outfall to the receiving channel.
			Transverse barriers every 100m in the road formation. Maintain transverse flow paths/ditches. Shallow toe drain with check dams if required.
15c(N), 15d(C) & 15e(C) Ch 33+350 to Ch 34+350	Annex I Transition Mire and Rich Fen habitat National & County Importance	Operational	Transverse barriers every 100m in the road formation. Maintain transverse flow paths/ditches. Shallow toe drain with check dams if required.

No.	Description

KER Receptor No.	Receptor Name and importance	Stage	Mitigation Measures Proposed
16 (N) Ch 36+650 to Ch 37+950	Cregga Turlough National Importance Annex I priority Habitat	Construction	A Construction Sediment Erosion and Control Plan (CSECP) has been developed – see Appendix 10.1. The measures outlined in the CSECP will ensure no adverse impacts on water quality occur.
		Operational	Interceptor ditches and filter drains will collect existing overland and interflow which discharge to the Turlough in three distribution galleries between Ch.36+500 to Ch.36+700, Ch.37+670 to Ch. 37+870 and Ch.38+030 to Ch.38+130. The existing ground will be excavated to bedrock and filled with free draining material to existing ground level to facilitate the dispersal/infiltration of overland drainage intercepted by the scheme. The provision of transverse impermeable bunds at 50m intervals to prevent longitudinal flow of sub-surface water will be incorporated within the free draining material. This will ensure that the existing water balance of the Turlough is maintained.
19(LH) Ch 52+850 to Ch 53+250	Scramoge River Local Importance (Higher Value)	Construction	A Construction Sediment Erosion and Control Plan (CSECP) has been developed – see Appendix 10.1. The measures outlined in the CSECP will ensure no adverse impacts on water quality occur.
		Operational	Road drainage will be treated in an attenuation pond with a grease trap provided prior to outfalling to receiving watercourse. The attenuation pond will be fitted with a penstock or similar restriction at the outfall to the receiving channel.
			All existing watercourses and local drainage channels will be maintained to ensure drainage of lands does not occur.

No.	Description
7.7	Requirements for diversion works are described in Section 10.5 of the EIAR and in the Construction Erosion and Sediment Control Plan and same shall be implement in full.
7.8	**Site Compound Controls** The measures outlined in the Construction Erosion and Sediment Control Plan shall be complied with in full. Foul drainage from all site offices and construction facilities will be contained and disposed of in an appropriate manner to prevent pollution of nearby watercourses in accordance with the relevant statutory regulations.
7.97.7	**Material Deposition Areas** The measures, controls, mitigations and procedures set out in the Construction Erosion and Sediment Control Plan shall be implemented in full. Double silt fences will be provided outside the proposed footprint of the material deposition areas in advance of commencement of construction works. All material recovery areas will be contained with engineered bunds constructed of engineering grade materials and not peat or soft material. Surface Water Outlets from these bunded areas shall be controlled (high level

No.	Description
	over flows / penstocks) and to pass through sedimentation ponds prior to discharge.
7.107.8	As detailed in the CESCP, prior to commencing works, the Contractor shall prepare an Emergency Response Plan based on a thorough risk assessment. The Contractor shall provide a full list, including the exact locations, of all pollution control plant and equipment to the Employer's Site Representative. All such plant and equipment shall be maintained in place and in working order for the duration of the works. All staff will be trained in the implementation of the Emergency Response Plan and the use of any spill kit/ control equipment as necessary. The Emergency Response Plan shall include a simplified Spill Response Plan that will be displayed at several locations throughout the site and at sensitive locations.

19.8. Mitigation Measures for Landscape & Visual Analysis

No.	Description
8.1	Mitigation of landscape and visual impacts for the proposed N5 Ballaghaderreen to Scramoge Road Project shall have regard to the approach as set out in the following NRA/TII guidance documents: • Guidelines for the Creation and Maintenance of an Environmental Operating Plan; • A Guide to Landscape Treatments for National Road Schemes in Ireland; • Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes; • Guidelines on the Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads.
8.2	Specific measures shall ensure that: • Site machinery shall operate within the proposed road development land acquisition boundary • Storage areas shall be located so as to avoid impacting further on existing residential and other property, woodlands, trees, hedgerows, drainage patterns, etc. • Solid site hoarding shall be provided where construction works closely adjoin residential property as indicated on Figure 11.26 to 11.50. • Where construction compounds are located within 200m of residential properties, solid hoarding or similar, of minimum 2.0m in height shall be provided for visual and general screening. • Construction compounds shall be fully-decommissioned and reinstated to their pre-construction condition at the end of the construction contract. • Except in rock cuttings, side slopes and other landscape areas along the proposed road development shall be prepared for soiling, and either seeded and/or planted at the earliest possible opportunity. As such, scope exists for undertaking significant areas of seeding and planting prior to the end of the construction works. However, due to construction programming and seasonal restrictions, it is also likely that significant planting works will not be undertaken until the end of the major construction phase.
8.3	The detailed design and implementation of landscape measures shall have regard to the following features: • Clearance zones (DN-GEO-03034 - Safety Barrier Standards); • Sight-lines, including at junctions and to carriageway signage, etc; • Location of cut-off drains at the top of cuttings and at the bottom of embankments; • The location and requirements for maintenance access along the mainline;

No.	Description
	• Locations where rock is encountered in cuttings. Such rock faces may be retained as geological features of the road corridor; • The location of noise barriers. **Note**: Due to the risk of Ash Dieback (*Chalara fraxinea*) and until further notice, ash (*Fraxinus* species) is no longer approved by the NRA/TII for planting schemes. This does impact on the use of Mountain ash – also known as rowan (*Sorbus aucuparia*).
8.4	Landscape mitigation proposals shall take full account of the approaches and principles as set out in A Guide to Landscape Treatments for National Road Schemes in Ireland, in particular to Chapter 4: Components of the Roadside Landscape; Chapter 5: Soil Geographic Factors; and Chapter 6: Landscape Treatments. Unless otherwise specified, seeding and planting proposals, including species and planting type and species shall be in accordance with Chapter 6 of these Landscape Guidelines.
8.5	General measures will be applied over the entire proposed road development, depending on the nature of the particular road section. Where feasible such measures shall include for the re-connection of field boundaries with hedgerows established along the boundary of the proposed road development. Trees within such hedgerows shall be randomly spaced in a visually naturalistic manner.
8.6	The provision of general mitigation measures such as hedgerows will be locally modified to incorporate other landscape treatments, which may negate the requirement for the hedgerow, *e.g.* blocks of native woodland planting or naturalising grassland meadows where it is considered appropriate to have open sections of carriageway. Open sections shall allow for views to the wider landscape where they do not impinge on requirements for screening residential properties or other amenities.
8.7	Proposals will ensure that planting is distributed along the entire proposed road development and the associated local road re-alignments and will vary from typical rural, randomly tree-lined hedgerow reinstatement to wide plantings of landscape and screen planting to the establishment of larger areas of new woodland for integration of the development into the wider landscape. Shrub planting will be used at the edges of the tree planting. This will increase the density and diversity of the plantings and improve the biodiversity structure.
8.8	Treatments will take into consideration the assessment and recommendations of the Biodiversity section of this EIAR (Chapter 7) and will ensure that in general, species which are locally indigenous and native are utilised in the proposed plantings. However, detailed proposals in terms of their nature and approach will consider the locally impacted environment and in terms of species may include non-native plants, *e.g.* beech at old demesnes or a more ornamental approach where garden plantings are disturbed.
8.9	Where areas are in cut or fill, a grass or meadow sward will generally be established over the entire slope except in areas of cutting through stable rock (see Landscape Guidelines, Section 4.2: Cuttings and Embankments). Stable rock slopes will be retained as an exposed face for natural colonisation and as a local landscape feature. In general it is not proposed to plant either cut or fill slopes in their entirety, but to encourage a more naturalistic and locally sympathetic grouping of plantings within a naturalising grass sward. Slopes may also be seeded to wildflower grassland and hydro-seeding may be utilised for seeding of steep slopes.
8.10	Along the length of the proposed road development, landscape areas within junctions and small areas of severed fields, plots or other property acquired for the construction of the proposed road development will be varyingly treated including being planted in a semi-natural copse like fashion with native woodland species. Such woodland blocks dispersed along the proposed road development will assist in the improvement of the longer-term visual character of the proposed road

No.	Description
	development and local surrounds. Particular attention shall be given to an appropriate extent and scale of planting in and surrounding junctions and embankments.
8.11	Certain areas along the length of the proposed road development have been set aside for drainage requirements/ pollution control/attenuation. Where such works are of a linear nature, disturbed sections of hedgerow will be reinstated / planted to match the existing. Where attenuation ponds are proposed these will be fenced and will be treated with appropriate hedgerow screen planting along the development boundary to minimise their impact.
8.12	In general the proposed planting will generally be established using bare-root transplants, whips and feathered trees which adapt readily to disturbed ground conditions. A proportion, totalling not less than 5% of 'Half-standard' (6-8cm girth & 200cm-250cm tall) and a further 5% 'Standard' (8-10cm girth & 250cm-300cm tall) trees shall be used to supplement these plantings especially in the vicinity of residential areas. All planting mixes will take cognisance of, and include native and local species as identified by the Ecological mitigation requirements.
8.13	Tree species utilised will be selected from a list of primarily native, naturalised and indigenous species (except where the proposed road development is contiguous with existing plantations containing other species such as conifers or beech *etc*), which will include alder, common ash (*subject to planting restrictions at time of works*), common birches, common oaks, mountain ash, Scots pine and willow species. Planting sizes will be from 75cm to 400cm in height and tree species will be planted at average 2.0m centres within the wider planting mix.
8.14	Shrub planting species utilised will be selected from a list of primarily native and indigenous species, which will include, blackthorn, elder, hawthorn, hazel, holly, guelder rose, spindle, willows and other plants found naturalised in the affected localities. Planting sizes will vary from 30 to 75cm in height and shrub species will be planted at between 1.0 and 1.5m centres depending of landscape type.
8.15	Hedge planting will be primarily of blackthorn and hawthorn interspersed with other species such as elder, hazel, holly and those found locally. Hawthorn within hedgerows shall be planted at between 75 to 90cm in height and at 500mm centres in each of 2 double staggered rows. The hedgerow will be interspersed with standard-sized randomly spaced tree species such as alder, common ash and oaks, as appropriate to particular locality.
8.16	Areas to be seeded to naturalising meadow will be thinly topsoiled (5cm layer) and seeded with a locally appropriate seed mix. Mainline and side road verges will be cultivated, topsoiled minimum 200mm deep and stone buried to remove stones down to 25mm diameter prior to seeding to a low-maintenance grass seed mix.
8.17	The proposed road development lighting design shall meet the requirements of BS EN 13201-2:2003 and BS5489-1: 2003, Code of Practice for Design of Road Lighting. Lighting of Roads and Public Amenity Areas and shall comply with the requirements of the TII/NRA DMRB TD 34-91. The detailed lighting design shall be completed in a manner, which will minimise glare and light pollution that in combination with extensive landscaping as proposed at junctions will ensure that light-spill effect is minimised. It is noted that the proposed road development includes for a minimum of roadside illumination, effectively restricted to roundabouts and along the immediate approaches to and from such features.
8.18	Specific Landscape and Visual Mitigation Elements and Treatments (refer to Figures 11.26 to 11.50) Note Proposed Road Development has been abbreviated to PRD in the following Table:

No.	Description

Reference	Location	Description of Measures
Verges & Roundabouts	Mainline and Local Roads Generally	Where appropriate, verges shall be provided along both sides of mainline. Verges will also be provided around junctions and along local road re-alignments and tie-ins. Verges and roundabouts shall be finished to even gradients, with minimum 200mm topsoil and stone buried or raked to be free of rubble and stones over 25mm diameter. Verges and roundabouts to be seeded to low-maintenance seed mix.
Cut slopes and Embankments	Mainline and Local Roads Generally	Cut slopes and embankments shall be finished to even gradients, topsoiled unless otherwise stated in this table or elsewhere in the EIAR. Slopes shall be free of rubble and stones over 50mm diameter. All such rubble/stone shall be removed or buried. Unless otherwise stated in the EIAR slopes shall be seeded to a low maintenance non-agricultural grassland or to a wildflower grassland. Rock cuttings may remain exposed as features of the road corridor and landscape.
Ponds, swales, 'V-drains' etc.	Generally	All slopes shall be evenly graded and free of rubble and stones over 50mm diameter. Slopes shall be seeded to low maintenance non-agricultural grassland or to a wildflower grassland, allowing for natural development over time. Steep slopes on pond edges and 'V-drains' shall be hydro-seeded. Areas around ponds shall be a diverse landscape of low maintenance grassland / species-rich wildflower grassland and plantings of low-canopy woodland and shrub planting. Hedgerows, of blackthorn and hawthorn, without tree species, shall be established along all non-roadside boundaries. Non-palisade type fencing (*e.g.* paladin, or timber post and rail) shall be used around pond areas.
Material Deposition Areas (**DA**)	See 'PA' on Figures 11.26 to 11.50 in Volume 3	Unless otherwise stated in the EIAR, material deposition areas shall be seeded to species-rich grassland and allowed to develop naturally. Between 15 and 25% of area shall be planted to a mosaic mix of alder, birch, Scots pine and willow species. Subsoil may be mixed into final surface to improve surface rigidity.
Noise barriers / bunds	Generally	Low-canopy woodland, hedgerow and/or shrub planting of native species shall be established as either a narrow planting of 3.0m minimum width or double-staggered hedgerow along the full off-road face of barriers. Low-canopy and/or shrub planting of native species shall be established on the full off road face of bunds. The planting shall include ash*, birch, blackthorn, elder, hawthorn, and/or willow species as appropriate. Plants shall be 90 to 120cm in height at planting.
Plants and Planting Areas	Generally	All tree species over 150cm in height together with all Pine shall be appropriately staked and tied. All failed, dead or defective plants shall be replaced before the end of each and every year of defect aftercare. Full planting area to free of stones over 50mm in diameter.

No.	Description

Reference	Location	Description of Measures
Grass	Generally	Grass areas shall provide full sward cover within 12 months of seeding. Any failed, bare or defective areas shall be re-seeded between March – May and/or August – September in each and every year of defect aftercare.
Unauthorised Access, Parking and/or Encampment	Generally	Landscape proposals shall avoid creating areas considered as being suitable for unauthorised parking and shall use landscape proposals to deter and prevent such use.
Headlight Impacts	Generally	Landscape proposals shall use specific landscape treatments to avoid and/or reduce the potential visual impact of headlights on residential and other sensitive property. The measure shall apply equally to the mainline, junctions, roundabouts, tie-ins and local and link roads.
(**RA**) Remnant Areas	Generally & refer to 'RA' on Figures 11.26 to 11.50 in Volume 3	Any remnant post-construction lands shall be treated to a diverse range of planting and non-planting proposals to include a minimum 50% Landscape Treatment Type 1 and/or Type 2 and/or Type 3, as locally appropriate. The remaining area shall be treated as locally appropriate low maintenance grassland / species-rich grassland.
(**SPT1**) Screen Planting Type 1 (refer to SPT1' on Figures 11.26 to 11.50 in Volume 3)	Planting at 1.0m centres for visual screening shall be of a minimum of 5m in width. The planting shall extend for a minimum of 100m to either side of any adjoining residential property or amenity.	Planting will include a minimum of 5% of 'standard-sized' trees (8-10cm girth); 5% of half-standard trees (6-8cm girth); 15% of 'whips' (minimum 150cm in height), together with a further 10% of evergreen Scots pine of minimum 60cm in height at planting. Standard and Half-standard tree species shall be alder and/or birch. Standard and Half-standard trees and Pine to be planted at average 2.5m centres throughout. The planting shall include a dense under-storey (at average 1 plant/metre) of woodland transplants and shrubs. Transplants, which shall include 20% Hawthorn, shall be between 90 to 120cm in height) Shrub species shall be 30 to 50cm in height and include a minimum of 10% holly.
(**SPT2**) Screen Planting Type 2 (refer to 'SPT2' on Figures 11.26 to 11.50 in Volume 3)	Planting at 1.0m centres for visual screening shall be of a minimum of 3m in width. The planting shall extend for a minimum of 100m to either side of any adjoining residential property or amenity.	Planting shall include a minimum of 5% of 'standard-sized' trees (8-10cm girth); 10% of half-standard trees (6-8cm girth); 25% of 'whips' (minimum 150cm in height). Standard and Half-standard tree species shall be alder and/or birch. Standard and Half-standard trees shall be planted at average 2.0m centres throughout. The planting shall include a dense under-storey (at average 1 plant/metre) of woodland transplants and shrubs. Transplants, which shall include 30% hawthorn, shall be between 90 to 120cm in height) Shrub species shall be 30 to 50cm in height and include a minimum of 25% holly.

No.	Description

Reference	Location	Description of Measures
(**BHT1**) Boundary Hedgerow Type 1 (refer to 'BHT1' on Figures 11.26 to 11.50 in Volume 3)	General double staggered hedgerow with tree planting	Primarily blackthorn (20%) and hawthorn (40%) hedgerow interspersed with other species such as elder, hazel, holly and those found locally. Hawthorn plants shall be between 75 to 90cm in height and planted at 50cm centres in each of two double staggered rows, 25cm apart. Other plants shall be interspersed and of between 30 to 50cm in height. The hedgerow shall be interspersed with 'standard-sized' (8-10cm girth) randomly planted alder and/or oak trees planted at random naturalistic spacings but averaging a min. of 1 tree per 25 linear metre.
(**BHT2**) Boundary Hedgerow Type 2 (refer to 'BHT2' on Figures 11.26 to 11.50 in Volume 3)	Double staggered hedgerow with little or no tree species	Primarily blackthorn (25%) and hawthorn (60%) hedgerow interspersed with other species such as elder, hazel, holly and those found locally. Hawthorn plants shall be of between 75 to 90cm in height and planted at 50cm centres in each of two double staggered rows, 25cm apart. Other plants shall be interspersed and of between 30 to 50cm in height. The hedgerow shall be interspersed with 'standard-sized' (8-10cm girth) randomly planted alder and/or oak trees planted at random naturalistic spacings but averaging a min. of 1 tree per 25 linear metre. Limited tree species, such as birch and mountain ash may be included as 'whips' at 150cm in height.
(**LTT1**) Landscape Treatment Type 1 (refer to 'LTT1' on Figures 11.26 to 11.50 in Volume 3)	General low-canopy woodland planted at average 1.5m centres	Area to be planted to native or indigenous woodland. Planting shall include a proportion, totalling not less than 5% of 'Half-standard' trees (6-8cm girth & 200cm-250cm tall) and a further 5% 'Standard' trees (8-10cm girth & 250cm-300cm tall) to be used to supplement a general planting of 10% tall whips (150cm minimum) 10% whips (120 - 150cm) 25% transplants (90-120cm), and shrub plantings. Species to include alder, birch, blackthorn, hawthorn, hazel, holly, mountain ash, oak, Scots pine and willows as locally appropriate. Half-standard and Standard-sized trees to be alder / ash*, mountain ash and/or oak.
(**LTT2**) Landscape Treatment Type 2 (refer to 'LTT2' on Figures 11.26 to 11.50 in Volume 3)	Semi-natural low-canopy woodland with limited tree species planted at average 1.5m centres	Area to be planted to native or indigenous semi-natural woodland with limited tree species. Planting shall include a proportion, totalling not less than 15% whips (120 - 150cm) 30% transplants (90-120cm) and shrub plantings. Species to include alder, birch, blackthorn, hawthorn, hazel, holly, mountain ash and willows as locally appropriate. If locally appropriate tree species may be omitted entirely.

No.	Description

Reference	Location	Description of Measures
(**LTT3**) Landscape Treatment Type 3 (refer to 'LTT3' on Figures 11.26 to 11.50 in Volume 3)	High-canopy Woodland planted at average 1.5m centres	Area to be established as native semi-natural high-canopy woodland containing higher percentage oak and/or Scots pine. Planting shall include a proportion, totalling not less than 5% of 'Half-standard' trees (6-8cm girth & 200cm-250cm tall) and a further 5% 'Standard' trees (8-10cm girth & 250cm-300cm tall) to be used to supplement a general planting of 10% tall whips (150cm minimum) 10% whips (120 - 150cm) 25% transplants (90-120cm), and shrub plantings. Species to include alder, birch, blackthorn, hawthorn, hazel, holly, mountain ash, oak, Scots pine and willows as locally appropriate. Half-standard and Standard-sized trees to be ash, and/or oak and Scots Pine to be minimum 10% of planting.
(**CS**) Construction Screening	Specifically as indicated on Figures 11.25 to 11.50 in Volume 3	Provide for solid screening hoarding for the duration of the construction stage for those properties most particularly impacted by the works.

19.9. Mitigation Measures for Noise & Vibration

No.	Description
9.1	The contract documents will clearly specify that the Contractor undertaking the construction of the works will be obliged to take specific noise abatement measures and comply with the recommendations of *BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Noise* and the European Communities (Noise Emission by Equipment for Use Outdoors) Regulations, 2001. These measures will ensure that: • No plant used on site will be permitted to cause an ongoing public nuisance due to noise. • The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations. • All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract. • Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers. • Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use. • Any plant, such as generators or pumps that is required to operate before 07:00hrs or after 19:00hrs will be surrounded by an acoustic enclosure or portable screen. • During the course of the construction programme, the contractor will be required manage the works to comply with noise limits using methods outlined in *BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Noise* "Noise and Vibration Control on Construction and open sites", Annex B.
9.2	Air overpressure from a blast is difficult to control because of its variability; however, much can be done to reduce the effect. In line with best practice mitigation measures from vibration sources, good communication and public relations are a key factor in reducing any startle effects to residents.

<table>
<tr><th>No.</th><th>Description</th></tr>
<tr><td></td><td>In this instance, a Public Communications Strategy will be implemented by the contractor prior to the commencement of any blast works. In such cases, the following recommended mitigation measures are proposed;
Residents within 200m of any locations for blasting will be notified before any work and blasting starts (e.g. a minimum of 24 hour written notification).
The firing of blasts will be undertaken, where possible, at similar times to reduce the 'startle' effect.
Ongoing circulars will be issued informing people of the progress of the blasting works.
The implementation of an onsite documented complaints procedure will be maintained by the contractor.
The use of independent monitoring will be undertaken by external bodies for verification of results.</td></tr>
<tr><td>9.3</td><td>Further guidance will be obtained from the recommendations contained within BS5228-2:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Vibration in relation to blasting operations. These will include some or all of the following:
All blasting will be undertaken by professionally trained blast contractors.
Restriction of hours within which blasting can be conducted (09:00 –18:00hrs).
Trial blasts will be tested in less sensitive areas to assist in blast designs and identify potential zones of influence.
The design, execution and completion of any blasting within 150 metres of any existing structure shall require special considerations. This will include the use of pre and post condition structural surveys by a competent structural engineer (see Item 9.8 below).
Ground vibration and air over pressure (AOP) will be recorded simultaneously for each blast at the most sensitive locations, depending on the works area being blasted.
When blasting moves into a new area, an initial low level blast will be carried out (i.e. a low Maximum Instantaneous Charge (MIC)) and monitoring will be carried out simultaneously at a number of sensitive properties in different directions in order to generate specific scaled distance graphs.
The scaled distance graphs will be used to determine the optimum MIC for subsequent blasts area in order control vibration and AOP limits below the relevant limit values (as set out in Section 12.4.1) at the nearest sensitive buildings;
Blasting contractors will ensure that the minimum amount of primer cord is used, and that no primer cord is located above ground.</td></tr>
<tr><td>9.4</td><td>The TII/NRA Guidelines recommend that in order to ensure that there is no potential for vibration damage during construction, vibration from construction activities should be limited to the values set out in the table below. The Contractor will therefore be required to adhere to these levels set out below.
Allowable vibration during road construction in order to minimise the risk of building damage.
<table><tr><th colspan="3">Allowable vibration velocity (Peak Particle Velocity) at the closest part of any sensitive property to the source of vibration, at a frequency of</th></tr><tr><th>Less than 10Hz</th><th>10 to 50Hz</th><th>50 to 100Hz (and above)</th></tr><tr><td>8 mm/s</td><td>12.5 mm/s</td><td>20 mm/s</td></tr></table></td></tr>
<tr><td>9.5</td><td>In the case of vibration levels giving rise to human discomfort, in order to minimise such impacts, the following measures shall be implemented during the construction period:
Alternative less intensive working methods and/or plant items shall be</td></tr>
</table>

<table>
<tr><th>No.</th><th>Description</th></tr>
<tr><td></td><td>employed, where feasible;
• Appropriate vibration isolation shall be applied to plant, where feasible;
• Cut off trenches to isolate the vibration transmission path shall be installed where required, and;
• In the case of impact piling or demolition works for instance, a reduction in the input energy per blow shall be considered where required.</td></tr>
<tr><td>9.7</td><td>Maximum Permissible Noise Levels at the Facade of Dwellings during Construction
<table>
<tr><th rowspan="2">Days and Times</th><th colspan="2">Noise Levels (dB re. $2x10^{-5}$ Pa)</th></tr>
<tr><th>$L_{Aeq(1hr)}$</th><th>L_{Amax}</th></tr>
<tr><td>Monday to Friday 07:00 to 19:00hrs</td><td>70</td><td>80</td></tr>
<tr><td>Monday to Friday 19:00 to 22:00hrs</td><td>60*</td><td>65*</td></tr>
<tr><td>Saturdays 08:00 to 16:30hrs</td><td>65</td><td>75</td></tr>
<tr><td>Sundays & Bank Holidays 08:00 to 16:30hrs</td><td>60*</td><td>65*</td></tr>
</table>
Note * Construction activity at these times, other than that required for emergency works, will normally require the explicit permission of the relevant local authority.
In the case that works are required on Saturday evenings (16:30 to 19:00hrs), works will be required not to exceed noise levels of 55dB $L_{Aeq(1hr)}$ and 65dB L_{Amax} at the Facade of Dwellings.
The emergency work referred to above may include the replacement of warning lights, signs and other safety items on public roads, the repair of damaged fences, repair of water supplies and other services which have been interrupted, repair to any damaged temporary works and all repairs associated with working on public roads.</td></tr>
<tr><td>9.8</td><td>Property condition surveys will be offered for all buildings within 50m of the development boundary and those within 150m of proposed blasting works along the proposed road development. Property condition surveys will also be carried out at buildings and structures considered appropriate relative to their proximity to the works. Such property condition surveys shall be carried out by a Chartered Surveyor or Chartered Structural Engineer. Such property condition surveys, subject to the written agreement of relevant property owners, shall be carried out in two stages as the follows:
• the first stage shall consist of pre-construction condition surveys including photographic records which shall be carried out prior to project commencement,
• the second stage shall consist of post-construction condition surveys which shall include photographic records.</td></tr>
<tr><td>9.9</td><td>Noise mitigation will be required at 10 properties (as shown below). In order to meet the noise thresholds set out in the TII/NRA EACG the proposed mitigation shall be provided in the form of acoustic barriers and/or earth bunds. In certain instances, it may be necessary to utilise a bund mounted acoustic barrier, however the required attenuation will be provided in so far as the barrier achieves the required height relative to the proposed road and receptor.</td></tr>
<tr><td></td><td>
<table>
<tr><th>Barrier Ref.</th><th>Incident to</th><th>Road Link</th><th>Chainage Start (m)</th><th>Chainage End (m)</th><th>Height (m)</th><th>Alignment/ Notes</th></tr>
<tr><td>NB-001</td><td>A02-005</td><td>N5</td><td>2+245</td><td>2+315</td><td>2</td><td>North</td></tr>
<tr><td rowspan="2">NB-002</td><td rowspan="2">A02-007</td><td>N5</td><td>2+225</td><td>2+290</td><td rowspan="2">2.5</td><td>South</td></tr>
<tr><td>Side road</td><td>0+000</td><td>0+050</td><td>East</td></tr>
<tr><td rowspan="2">NB-003</td><td rowspan="2">A02-020/ A02-021</td><td>N5</td><td>2+865</td><td>2+890</td><td rowspan="2">3</td><td>South</td></tr>
<tr><td>Side road</td><td>0+000</td><td>0+020</td><td>West</td></tr>
</table>
</td></tr>
</table>

No.	Description

Barrier Ref.	Incident to	Road Link	Chainage Start (m)	Chainage End (m)	Height (m)	Alignment/ Notes
NB-004	A02-020/ A02-021	N5	2+900	3+000	3	South
		Side Road	0+000	0+045		East
NB-005	B24-008_B	N61	0+005	0+060	1	East
		Side Road	0+000	0+015		South
NB-006	C33-005_A	N5	33+400	33+500	1	North
NB-007	C35-001_B	N5	35+020	35+080	1	North (absorptive)
NB-008	C35-002_B	N5	35+045	35+095	1	South (absorptive)
NB-009	D52-007_A	N5	52+730	52+790	1.5	South
NB-010	D53-013 A	N5	53+640	53+710	1.5	South

19.10. Mitigation Measures for Air Quality & Climate

No.	Description
10.1	A dust minimisation plan shall be incorporated into the EOP in accordance with NRA guidance. Mitigation measures within the plan will include: • Hard surface roads will be swept to remove mud and aggregate materials from their surface while any un-surfaced roads will be restricted to essential site traffic. • Furthermore, any road that has the potential to give rise to fugitive dust will be regularly watered, as appropriate, during dry and/or windy conditions. • Vehicles using site roads will have their speed restricted, both on un-surfaced site roads and on hard surfaced roads, as site management dictates. • Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities such as rock blasting or demolition are necessary during dry or windy periods. • Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions and cleaned as necessary. At all times, these procedures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust will be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.

19.11. Mitigation Measures for Archaeology & Cultural Heritage

No.	Description
11.1	Mitigation measures shall be undertaken as directed by the Minister for AHRRGA in compliance with national policy guidelines and statutory provisions for the protection of archaeology and cultural heritage.
11.2	

ID No.	Site Type	Mitigation
AH4	Possible post medieval earthen platform.	Preservation by record. Test trenching will determine the nature and extent of this feature.

No.	Description
11.3	

ID No.	Site Type	Mitigation
AH9	Mound – possible fulacht fia	Preservation by record. Targeted test excavation of the site within the landtake and the wider area within the landtake.
AH11, AH12	2 possible enclosures	Preservation by record. Targeted test excavation of the site within the landtake and the wider area within the landtake.
AH14	A possible hollow way	Preservation by record. Targeted test excavation of the site within the landtake and the wider area within the landtake.
AH19, AH20	2 possible hollow ways	Preservation by record. Targeted test excavation of the sites within the landtake and the wider area within the landtake.
AH23	Drummin Mound/ possible Burnt Mound SMR RO015-077	Preservation by record. Targeted test excavation of the site within the landtake and the wider area within the landtake.
AH28	Existing forestry track (possible extension to recorded route way (RO022-056002)	Targeted test excavation did not reveal any trace of an historic route (TE1), test excavation will occur within the wider landtake.
AH29	Pit field (LiDAR 33.2)	It was concluded that the pit-like depressions are natural enclosed karstic depressions and are of no archaeological significance. No further mitigation necessary, test excavation will occur within the wider landtake.
AH30	Earthwork – series of banks and ditches identified by fieldwork	Preservation by record. Targeted test excavation of the site within the landtake and the wider area within the landtake.
AH31	Recorded pit field (RO016-151).	Test trenching did not reveal any features of an archaeological significance. It was concluded that during the programme of archaeological test trenching, the presence of a geologist will allow for recording of further data in order to determine a more conclusive interpretation for the origin of the pits.
AH32	Possible pit/tree lined depression likely to be geological in nature.	Likely to be non-archaeological and natural in origin. Preservation by record. Test excavation will be undertaken within the landtake to understand the nature of the depression/ pit feature. The presence of a geologist will allow for recording of further data in order to determine a more conclusive interpretation for the origin of the pits.
AH33	Possible curvilinear enclosing earthen banked boundary also townland boundary between Corry East & Cloonyeffer.	Preservation by record. Targeted test excavation in order to verify the nature and extent of this boundary.
AH29A	Single sub-surface pit identified by test excavation.	Preservation by record (full excavation) of the identified single pit.
AH44	Potential rectangular enclosure site. LiDAR (40.5)	Preservation by record. Targeted test excavation of the potential site that lies partially within the landtake and test excavation of the wider area within the landtake.

No. 11.3 contd.

ID No.	Site Type	Mitigation
AH46	Possible Burnt Mound (SMR RO022-163)	The site is to be avoided and fenced off during the construction of the proposed road development.
AH48	Possible enclosure (LiDAR (42.10). Interpreted as a possible small field enclosure by geophysical survey	The site is to be avoided and fenced off during the construction of the proposed road development.
AH53	Redundant record (RO022-015) – earthworks. Geophysical survey (GA6). AH53 is the same site as AH54.	Preservation by record. Targeted test excavation of the section of the possible earthworks/ field system within the landtake and test excavation of the wider area within the landtake.
AH54	On the site of the redundant record. LiDAR (42.3) & geophysical survey (GA6) revealed a possible field system.	Preservation by record. Targeted test excavation of the section of the possible earthworks/ field system within the landtake and test excavation of the wider area within the landtake.
AH57	Enclosure – identified by LiDAR (45.5), and geophysical survey (GA6). Confirmed by test excavation.	Preservation by record. Excavation of the southern part of the enclosure located within the landtake and test excavation of the wider area within the landtake.
AHA	Shankill townland, features revealed as a result of test excavation	Preservation by record. Excavation of the newly revealed features including 5 pits, 8 furrows, 4 ditches, 1 slot trench and 2 isolated hearths located within the landtake and test excavation of the wider area within the landtake.

No. 11.4

ID No.	Site Type	Mitigation
AH58	Possible enclosure (SMR R0022-167); LiDAR (45.4) 13m in diameter possibly a ring barrow. Area subject to geophysical survey (GA7) and test excavation (TE4), revealed to be non-archaeological. Test excavation revealed a single pit and two linear features.	Preservation by record through excavation in full of any identified archaeological remains.
AH59	Field system, (LiDAR (45.3). Identified by geophysical survey and confirmed by test excavation.	Preservation by record. Excavation of the field system that lies within the landtake and test excavation of the wider area within the landtake.
AH59A	Geophysical survey (GA7) revealed a possible ring barrow. Test excavation confirmed a small circular enclosure (20m)	Preservation by record. Excavation of the enclosure within the landtake and test excavation of the wider area within the landtake.

No.	Description
11.4 contd.	

ID No.	Site Type	Mitigation
AH61	Hollow way identified by field inspection and visible on aerial photography	Preservation by record. Targeted test excavation of the hollow way within the landtake and test excavation of the wider area within the landtake.
AH70	Possible enclosure (SMR RO022-170); LiDAR (49.3) identified an oval enclosure, possibly a small ringfort. Geophysical survey (GA8) noted archaeological responses.	Preservation in situ by design. The slopes of the mainline have been steepened and retained to avoid a direct impact on the site. Access track to be raised and avoid the site.
AH72	Possible enclosure; LiDAR (51.1) & geophysical survey (GA9). Test excavation confirmed the presence of an enclosure 33m north-south x 25m east-west	Preservation by record. Excavation of the enclosure within the landtake and test excavation of the wider area within the landtake.
AH75	A possible rectilinear enclosure marked as a property plot on the 1st edition six-inch OS. Geophysical survey did not detect any significant results (GA10)	Preservation by record. Targeted test excavation of the section of the possible enclosure within the landtake and test excavation of the wider area within the landtake.
AH81	Possible enclosure; LiDAR (54.2), 48m in diameter, possible ringfort	Preservation by record. Targeted test excavation of the section of the possible enclosure within the landtake and test excavation of the wider area within the landtake.
AH82	Small mound identified by field work	Preservation by record. Targeted test excavation of the small mound within the landtake and test excavation of the wider area within the landtake.
AH86	Field system; LiDAR (61.8), likely to be post-medieval in date	Preservation by record. Targeted test excavation of the section of the field system that lies partially within the landtake and test excavation of the wider area within the landtake.
AH88	Rectilinear enclosure identified by field inspection	Preservation by record. Targeted test excavation of the section of the rectilinear enclosure that lies partially within the landtake and test excavation of the wider area within the landtake.
AH93	Relict field boundary – two sections identified by field inspection	Preservation by record. Targeted test excavation of a section of the relict field boundary that lies partially within the landtake and test excavation of the wider area within the landtake.
AH94	Local knowledge suggested the presence of 2 ringforts – Geophysical survey (GA13) concluded that the area contained no significant findings	Preservation by record. Targeted test excavation of the field where previous surveys have taken place and test excavation of the wider area within the landtake.

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<tr><th>No.</th><th>Description</th></tr>
<tr><td>11.5</td><td>
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<tr><th>ID No.</th><th>Site Type</th><th>Mitigation</th></tr>
<tr><td>AH98</td><td>Possible pit field; identified by LiDAR (65.1), field inspection and geophysical survey (GA11).</td><td>Preservation by record. Test excavation of the wider area within the landtake, while the presence of a geologist will allow for recording of further data in order to determine a more conclusive interpretation for the origin of the pits..</td></tr>
<tr><td>AH98A</td><td>Redundant Record SMR RO023-219 added to the record 8 August 2016. Geophysical survey did not detect a hollow way or possible road feature at this location within the proposed landtake.</td><td>Preservation by record. Test excavation of the wider area within the landtake.</td></tr>
<tr><td>AH99</td><td>Possible pit field/ Relict field system (LiDAR 69.5), and geophysical survey (GA11).</td><td>Preservation by record. Test excavation of the relict field system and the wider area within the landtake. At the time of the archaeological resolution of the site, the presence of a geologist will allow for recording of further data in order to determine a more conclusive interpretation for the origin of the pits.</td></tr>
<tr><td>AH101A</td><td>Fulacht fia and burnt spread identified by test excavation</td><td>Preservation by record. Excavation of the fulacht fia and test excavation of the wider area of the landtake.</td></tr>
<tr><td>AH103</td><td>Possible pit field; identified by LiDAR (69.1), field inspection. geophysical survey (GA11).</td><td>Preservation by record. Test excavation of the wider area within the landtake. At the time of the archaeological resolution of the site, the presence of a geologist will allow for recording of further data in order to determine a more conclusive interpretation for the origin of the pits.</td></tr>
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<tr><td>11.6</td><td>
<table>
<tr><th>ID No.</th><th>Site Type</th><th>Mitigation</th></tr>
<tr><td>CHC1, 2, 5, 7, 8 & 12</td><td>Potential below ground remains of 6 structures shown on 1st edition mapping</td><td>Preservation by record and targeted test excavation will ascertain whether there are surviving below ground remains associated with these structures.</td></tr>
<tr><td>CHC6</td><td>Vernacular House</td><td>Preservation by record. The house and outbuilding will be recorded by means of measured survey, photography and written description prior to commencement of works.</td></tr>
<tr><td>CHC11</td><td>Upstanding, stone built structures in ruins.</td><td>Structure will be recorded by means of a measured survey, photography and written description.</td></tr>
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<tr><td>11.7</td><td>
<table>
<tr><th>ID No.</th><th>Site Type</th><th>Mitigation</th></tr>
<tr><td>CHC13, CHC14, CHC15</td><td>Potential below ground remains of 3 structures identified from 1st edition six-inch OS mapping</td><td>Preservation by record and targeted test excavation will ascertain whether there are surviving below ground remains associated with these structures.</td></tr>
<tr><td>CHC16</td><td>Former Hermitage Demesne (Chapter 15, BH-B01)</td><td>Preservation by record of the dry stone walls by means of a measured survey, photography and written description. Targeted test excavation of lands within the landtake.</td></tr>
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<tr><th>No.</th><th>Description</th></tr>
<tr><td>11.7 contd.</td><td>
<table>
<tr><th>ID No.</th><th>Site Type</th><th>Mitigation</th></tr>
<tr><td>CHC17, CHC18</td><td>2 buildings recorded on 1st edition OS map – no visible trace</td><td>Preservation by record and targeted test excavation will ascertain whether there are surviving below ground remains associated with these structures.</td></tr>
<tr><td>CHC22,</td><td>4 buildings recorded on 1st edition OS map – no visible trace</td><td>Preservation by record and targeted test excavation will ascertain whether there are surviving below ground remains associated with these structures.</td></tr>
<tr><td>CHC25</td><td>Mantua – Demesne (Chapter 15, BH-B02 and BH-B04)</td><td>Architectural Heritage (Chapter 15) recommends that broadleaf trees to be replanted at the margins of the new road, whilst a new stone wall, earth bank and tree and hedge planting will also be provided at the new margin of the demesne. Preservation by record and test excavation will occur within the landtake.</td></tr>
<tr><td>CHC26, CHC27</td><td>Sites of four structures recorded on the 1st edition OS - no visible trace</td><td>Preservation by record and targeted test excavation will ascertain whether there are surviving below ground remains associated with these structures.</td></tr>
<tr><td>CHC31</td><td>Site of Yambo House</td><td>The structure will be recorded by means of measured survey, photography and written description prior to commencement of works.</td></tr>
<tr><td>CHC34</td><td>Lands associated with former Raheen Demesne. No features associated with the demesne will be affected by the proposal.</td><td>Preservation by record and targeted test excavation will ascertain whether there are surviving below ground remains associated with this former demesne lands.</td></tr>
<tr><td>CHC35, CHC36, CHC37</td><td>Site of structures recorded on 1st ed. six-inch OS map – no visible trace</td><td>Preservation by record and targeted test excavation will ascertain whether there are surviving below ground remains associated with these structures.</td></tr>
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<tr><td>11.8</td><td>
<table>
<tr><th>ID No.</th><th>Site Type</th><th>Mitigation</th></tr>
<tr><td>Shankill CHC B</td><td>Bettyfield Demesne – former demesne lands</td><td>No mitigation measures proposed.</td></tr>
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<tr><td>11.9</td><td>
<table>
<tr><th>ID No.</th><th>Site Type</th><th>Mitigation</th></tr>
<tr><td>CHC39, CHC40, CHC41, CHC43, CHC45, CHC46, CHC47, CHC49, CHC50, CHC51, CHC52, CHC56</td><td>Potential below ground remains within 13 areas containing 21 structures identified from cartographic sources. No visible trace.</td><td>Preservation by record. Targeted test excavation will ascertain whether there are surviving below ground remains associated with these structures.</td></tr>
<tr><td>CHC51</td><td>The upstanding remains of a farmhouse, built of stone, with the remains of a stone-built outhouse or shed also in the vicinity.</td><td>The features will be recorded by means of measured survey, photography and written description prior to commencement of works</td></tr>
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<tr><th>No.</th><th>Description</th></tr>
<tr><td>11.9 contd.</td><td>
<table>
<tr><th>ID No.</th><th>Site Type</th><th>Mitigation</th></tr>
<tr><td>CHC44A</td><td>Site of quarry, field kiln and former access track</td><td>Recording of extant features by archaeological methods. Preservation by record. Targeted test excavation to ascertain whether there are surviving below ground remains associated with these structures.</td></tr>
<tr><td>CHC55</td><td>Field system and site of structure</td><td>Preservation by record. Targeted test excavation of the section of the field system & site of structure within the landtake and test excavation of the wider area within the landtake.</td></tr>
<tr><td>CHC54</td><td>Set of upstanding pillars with cast iron gates and the possible foundations of two structures depicted on the 1st edition six-inch OS mapping</td><td>Preservation by record and targeted test excavation of the site of the two structures. The gate pillars will be recorded by means of a measured survey, photographic survey and written description prior to commencement of works.</td></tr>
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<tr><td>11.10</td><td>
<table>
<tr><th>ID No.</th><th>Site Type</th><th>Mitigation</th></tr>
<tr><td>CHC57, CHC58, CHC59, CHC60, CHC61</td><td>Potential below ground remains within 5 areas containing 21 structures Identified on the 1st edition six-inch OS mapping no visible remains.</td><td>Preservation by record. Targeted test excavation of the sites of structures within the landtake and test excavation of the wider area within the landtake.</td></tr>
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<tr><td>11.11</td><td>
<table>
<tr><th>ID No.</th><th>Site Type</th><th>Mitigation</th></tr>
<tr><td>CHC62, CHC64, CHC70, CHC71, CHC72, CHC73, CHC74</td><td>Potential below ground remains identified in 8 discrete areas and containing 19 structures identified from cartographic sources and no longer visible</td><td>Preservation by record. Targeted test excavation will ascertain whether there are surviving below ground remains associated with these structures within the landtake, record any subsurface structural remains.</td></tr>
<tr><td>CHC63</td><td>LiDAR (65.2) identified an enclosure, almost certainly modern in origin. Recorded on the 1st edition six-inch OS as a structure and property plot and currently defined by a ditch</td><td>Preservation by record. Targeted test excavation of the site of the structure within the landtake, record any subsurface structural remains. Test excavation of the proposed route will ascertain whether there are surviving below ground remains associated with this structure.</td></tr>
<tr><td>CHC65</td><td>Strokestown Demesne – former parkland associated with the demesne</td><td>Replacement planting in a mix of native species and create a record of any stone walls that are removed by means of a measured survey, photography and written description.</td></tr>
</table>
</td></tr>
<tr><td>11.12</td><td>Mitigation measures for sites AH100, AH101, AH105, AH67, AH73, AH77, AH80, AHA and AH50 which are likely to be subject to indirect impacts will comprise planting and screening strategies developed by the landscape architect to ensure the sensitive incorporation of the proposed road development into the existing landscape.</td></tr>
<tr><td>11.12</td><td>Where townland boundaries are affected same shall be subject to a detailed survey. The aim of this survey shall be to make a representative written and photographic record of the townland field boundaries impacted on by the proposed</td></tr>
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No.	Description
	road development and provide additional information on the system of enclosure in this area of North Roscommon. The survey will consist of a photographic and written record of the nature and structure of the boundary, followed by a single machine-dug test trench through each townland field boundary where feasible. The test trench shall be of a sufficient length and width so as to provide a section through the boundary. The resulting section through the townland boundary shall then be drawn and photographed with a written description. In those instances where townland boundaries are formed by watercourses, no test excavations shall be required and where in such cases these watercourses are being impacted on by the proposed road development that shall be assessed by an underwater and or wade survey.
11.13	In general test excavation is not conducted within 10m of the bank of any stream or river which traverses the proposed road development. This measure is to protect the aquatic life and to avoid contamination of the watercourse by silt or spoil from test trenches. When investigating the rivers (AH 6, 21, 64, 104 and 108) all vegetation should be stripped back from the sides of the banks so a clear uninterrupted assessment can be made. Test excavation of the river banks and/or visual assessment and metal detection survey of the river bed and banks can take place once the vegetation has been cleared.
11.14	It is proposed that further geophysical survey will be carried out in areas where ground conditions are appropriate, for example the following areas of bogland, former bogland and forestry plantations may prove to be problematic: Turlaghamaddy and Dungar ch 4+250-5+300 Leggatinity ch 10+150-12+400 Ballaghcullia ch 14+100-15+550 Peak ch 15+550-15+700 Mullenduff and Corry West ch 16+700-18+100 Cartronagor and Creeve ch 21+000-22+900
11.15	It is proposed that a programme of archaeological blanket test excavation in accordance to the guidelines be undertaken within the land acquisition area of the proposed road development. The archaeological test trenching strategy shall entail mechanical excavation of a 2m wide (or at least a 1.8m wide) trench along the centre-line of the proposed route with regular off set trenches to the edge of the land to comprise a testing sample of a minimum of 12% of the dry-land take and 10% of the wet land take. The frequency and pattern of the trenching layout is not prescribed and the testing array may vary from one area to another, with the agreement of the TII archaeologist and the DAHRRGA, to take account of local topographic factors. In areas of increased archaeological potential the level of testing can be increased accordingly.
11.16	In general test excavations in wetland areas will take place in accordance to the *Guidelines for the Testing and Mitigation of the Archaeological Wetland Heritage for National Road Schemes* (NRA 2005).
11.17	Features and sites that have been investigated by advance test excavation at the EIAR stage of the project and proven to be archaeological in nature will have to be excavated by hand, for example the newly revealed fulacht fiadh in Lavally townland (AH101A) and the series of pits and linear features at Shankill townland.
11.18	Archaeological test trenches previously opened within the land acquisition area of the proposed road development will be appropriately reinstated in association with an agreed landscape strategy for the preservation in situ of the newly identified archaeological remains. If the road is approved these features will be fully excavated at the next stage of the contract.
11.19	Measures will have to be put in place to protect all archaeological features that are

No.	Description
	revealed prior to backfilling. This generally involves placing a geotextile protective membrane over any archaeological features identified during the test excavation exercise. Other measures such as the provision of hardboard over fragile remains must be used where appropriate. This is in accordance with the Code of Practice between the NRA and the Minister for AHRRGA (formerly Arts, Heritage, Gaeltacht and Islands), 2000.

19.12. Mitigation Measures for Architectural Heritage

Twenty structures have been identified as being affected by the proposed road to the extent that mitigation is required to protect or record the structure.

No.	Description
12.1	**Site BH-A02** The house and associated structures are to be recorded by means of measured drawings, photographs and written descriptions.
12.2	**Site BH-A05** The building is to be recorded by means of measured drawings, photographs and written descriptions.
12.3	**Site BH-B02** The margins of the new roads are to be replanted with broadleaf trees.
12.4	**Site BH-B04** A new section of a sinuous earth bank and tree and hedge planting is to be undertaken to the north of the new road alignment to replace the section that is to be removed. This is to follow the sinuous pattern of the existing bank at the northern margin of the planted strip and continue to the eastern end of the road frontage of the demesne.
12.5	**Site BH-B06** The affected structures should be recorded by means of photographs and written description prior to the commencement of the works.
12.6	**Site BH C04** The structure is to be recorded by means of written and photographic description.
12.7	**Site BH C09** The structure is to be recorded by means of measured drawings and written and photographic description.
12.8	**Site BH-C10** The structure is to be recorded by means of measured drawings and written and photographic description.
12.9	**Site BH-C13** If the change in levels at the gates affect the functioning of the gateway operated it will be necessary to reset the gates to a revised level.
12.10	**Site BH-C14** The structure is to be recorded by means of measured drawings, photographs and written description prior to demolition.
12.11	**Site BH-C15** The structure is to be recorded by means of measured drawings and written and photographic description.
12.12	**Site BH-C16** The house will be recorded by means of measured drawings, photographs and written description prior to demolition.
12.13	**Site BH-C18** Walls which are removed are to be rebuilt adjacent to the realigned LP-1405 road.
12.14	**Site BH-C19** The stile is to be recorded prior to removal by means of photographs and written description and is to be rebuilt into the new roadside wall.
12.15	**Site BH-C20** The well is to be recorded by means of measured drawings, photographs and written description prior to its removal.
12.16	**Site BH-C21** The gates and gate piers are to be recorded with photographs and written description prior to their removal. Following removal the pier caps are to be stored in a safe location.
12.17	**Site BH-C23** The stile will be recorded by means of photographs and written

No.	Description
	description prior to its removal.
12.18	**Site BH-D01** A condition survey and vibration analysis of the structure has been undertaken. A thorough engineering inspection of the structure shall be undertaken immediately prior to construction (subject to the owner's consent). A programme of monitoring will be implemented to ensure that condition limits are not exceeded and that all the relevant recommendations are met.
12.19	**Site BH-D03** Replacement planting is to be undertaken to supplement the trees that remain following the construction of the road.
12.20	**Site BH-D06** The two surviving parts of the bridge will be protected during construction.

19.13. Mitigation Measures for Material Assets & Land – Agriculture

No.	Description
13.1	The following general mitigation measures will be provided: • Access will be restored to lands where it is removed or restricted. The location of such access will be at a suitable location and, where possible, with the agreement of the landowner. • In general, permanent fencing will be timber post and rail fence with chain-link wire mesh in accordance with TII Standard Construction Details (SCDs) and referenced as CC-SCD-00301. Alternatively, permanent fencing may consist of timber post and tension mesh fencing in accordance with CC-SCD-00320. Where permanent fencing occurs within the clear-zone area it will be in accordance with CC-SCD-00320. Attenuation ponds will also be securely fenced. Where permanent fencing is erected on the boundary of the proposed N5 national road mainline or the associated attenuation ponds, it will be maintained by the Local Authority. • For farm holdings with equestrian livestock, permanent fencing will be timber post and rail fence with chain-link wire mesh in accordance with TII Standard Construction Details Drawing No. CC-SCD00302. Alternatively, permanent fencing may consist of timber post and tension mesh fencing in accordance with CC-SCD-00321. Where permanent fencing occurs within the clearzone area it will be in accordance with CC-SCD-00321. Where permanent fencing is erected on the boundary of the proposed N5 national road mainline or the associated attenuation ponds, it will be maintained by the Local Authority. • In general, on non-national road side road tie-ins with the proposed project, the permanent fencing will be timber post and rail fence with chain-link wire mesh in accordance with NRA Road Construction Details Drawing No. CC-SCD-00301 unless otherwise agreed with the landowner and will be maintained by the landowner subject to the clear zone requirements stipulated above. • All existing land drains and watercourses severed by the proposed road will either be directed to a culvert under the proposed road and / or associated side road realignments or will be incorporated into the new road drainage system. The new drainage system will be designed to ensure that the current drainage situation will not be made any worse and there will be no increased risk of flooding as a consequence of the proposed road project. • Any services that are interfered with as a result of the proposed road development will be repaired / replaced without unreasonable delay. • Ducting for the restoration of water and power supply services will be provided, as necessary, at a suitable location with the agreement of the landowner.
13.2	Good communication between the contractor and adjacent landowners during the construction phase, especially when excessively loud activities are programmed

No.	Description
	will prevent undue disturbance to farm animals due to noise. It will also facilitate farm enterprises so that valuable livestock sensitive to noise can be moved away from the construction work during critical times.
13.3	Access will be restored to lands where it is removed or restricted by the proposed road project. The location of such access will be at a suitable location and, where possible, with the agreement of the landowner. Good communication between individual farmers and the contractor will minimise difficulties caused by the restriction of access to land. Temporary fencing will be erected as required to delineate the site boundary and to minimise disturbance to adjacent lands. Temporary access gates may be required until such time as the permanent access arrangements are in place.
13.4	In cases where impeded drainage during construction will cause obvious difficulty to a particular landowner, temporary measures will be looked at on a site specific basis. This may include allowing waters to drain to less critical areas, so as to minimise the impact.
13.5	Where required, an alternative source of water / electricity will be provided to ensure that disruption to farming is minimised during the construction phase.

19.14. Mitigation Measures for Material Assets & Land – Non-Agriculture

No.	Description
14.1	The TII/NRA's Code of Practice Guide to Process and Code of Practice for National Road Project Planning and Acquisition of Property for National Roads will be adhered to with respect to all lands potentially impacted by the proposed works. The following general mitigation measures are proposed for the proposed project: • Access will be maintained to all affected property. • Where part of a curtilage of a property is to be permanently acquired, the acquiring authority will hold discussions with the property owner and generally agree to replace boundaries on a like for like basis, subject to safety considerations, or it will be treated as a compensation issue. • Prior to construction and subject to written agreement of the relevant property owners, property condition surveys will be undertaken in relation to all buildings / structures in use located within 50 metres of the extents of the CPO boundary. • Any services that are interfered with as a result of the road project will be repaired / replaced without unreasonable delay.
14.2	Access shall be maintained to all properties during the construction works. Where access is impeded to properties alternative access arrangements will be made on a case by case basis without undue delay. Traffic management measures will be put in place during construction where temporary or minor diversions are required.
14.3	Timing of works and noise and vibration limit values are amongst the main measures to mitigate noise impacts on sensitive receptors. These measures are detailed within Chapter 12 Noise and Vibration.
14.4	Dust suppression measures to mitigate the production of dust will be employed.
14.5	Where drainage is impeded during construction, temporary measures will be provided on a site specific basis including drainage of surface waters to less critical areas, so as to minimise any impact.
14.6	Consultation with property owners will be necessary to ensure these services are maintained and reinstated. When the interruption of such services is required, reasonable prior notice shall be given and services shall be restored in a timely manner.