7 Ecology and Biodiversity

7.1 Introduction

This section assesses data on flora, fauna and habitats within the study area in order to identify receptors potentially sensitive to flood risk management options, or which may constrain the implementation of certain options.

For the purposes of this report, the constraints study area is defined as an area approximately 15km in radius from the urban area of Graiguenamanagh along the banks of both the River Duiske and Barrow where potential measures are proposed. This is shown in Figure 7-1 below.

7.2 Methodology

A desktop assessment and a Preliminary Ecological Assessment (PEA) were carried out to identify features of ecological importance which have potential to be affected by the proposed development. It compromises of both a desk study and a walkover survey. A PEA (as described by the Chartered Institute of Ecology and Environmental Management (CIEEM) (Chartered Institute of Ecology and Environmental Management, 2017) is the term used to describe a rapid field assessment of the ecological features present, or potentially present, within a site of the surrounding area based on a visit to the site at a suitable time of the year. It involves describing the habitats and species present at the site based on visual and photographic surveys. The PEA is undertaken also to make a preliminary assessment of the likely impacts of a development. The assessments included an examination of aerial imagery and other available datasets to investigate the potential for connectivity to designated and ecologically sensitive areas, as well as a review of available literature e.g. NPWS data on European sites.

7.2.1 Desktop Study

During the desktop study, information was collated from readily available sources including:

- National Parks and Wildlife Service (NPWS) (https://www.npws.ie/maps-and-data/habitat-and-species-data (accessed September 2020))
- Development Applications Unit of the Department of Arts, Heritage and the Gaeltacht
- Birdwatch Ireland
- Inland Fisheries Ireland.
- The Atlas of Breeding Birds in Britain and Ireland (Sharrock, 1976)
- The New Atlas of Breeding Birds of Britain and Ireland (Gibbons et al., 1993)
- NPWS site synopses, satellite images of the area and OPW Discovery Series maps.
- Fish Stock Assessment of the River Barrow Catchment (Delanty et al. 2017, p. 49) (Delanty, 2017, p. 49)

- Information on the River Barrow catchment was sourced from websites of and publications from the following organisations:
    - National Parks and Wildlife (National Parks and Wildlife Service, 2015);
    - The Environmental Research Unit (Environmenal Research Agency, 1992, p. 507);
    - The Environmental Protection Agency (Environmental Protection Agency, 2018); and
    - Inland Fisheries Ireland.

7.2.2 Site Walkover

Habitats which might be affected by the development were identified and their suitability to support sensitive, rare and protected species was assessed (having regard to the typical ranges of species known to occur in the locality).

The walk over survey involved examining and recording the habitats and flora and fauna that are present along the river bank and photographing representative elements of these. All identifications were made in the field and binoculars were used to identify birds.

1.2.3 Legislation and Guidance

In assessing the potential impacts on the prevailing biodiversity, due regard was had to relevant legislation and guidance including:

- EIA Directive (2014/52/EU);
- Planning and Development Acts 2000 – 2018 and Planning and Development Regulations 2001-2019;
- Wildlife Act 1976 and as amended;
- Flora (Protection) Order 2015;
- Inland Fisheries Act 1959 – 2010;
- EU Water Framework Directive 2000/60/EC;
- European Communities (Birds and Natural Habitats) Regulations 2011 (as amended);
- Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine (Chartered Institute of Ecology and Environmental Management (CIEEM, 2018 (updated September 2019));
- Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment (European Union, 2013);

- Ireland's National strategy for Plant Conservation: progress towards 2020 (Smyth, N. Cole, E. Kelleher, C, Jebb, M & Lynn, D., 2019);
- Ireland's Marine Strategy Framework Directive Article 19 Report Initial Assessment, GES and Targets and Indicators (Marine Institute, October 2013);
- National Biodiversity Action Plan 2017-2021 (Department of Culture, Heritage and the Gaeltacht, 2011); and,
- Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters (Inland Fisheries Ireland, 2016).

This section of the report has been compiled from a preliminary ecology report based on a site walkover and desktop assessment undertaken by Aquafact Ltd. and a bat study comprised of a site survey and desktop assessment prepared by Cuthbert Environmental.

The site visits were undertaken prior to the location or details of the proposed flood storage areas being made available and, where suitable and data is publicly available, desktop study has been used to characterised the baseline for these areas to identify key constraints. Further baseline data collection for the flood storage areas will be undertaken during the EIA process.

A number of other factors that are also relevant to ecology due to their interactions, e.g. hydrology, hydrogeology and population and human health, are detailed in the relevant sections of this report.

7.3 Baseline / Receiving Environment

After the River Shannon, the River Barrow is Ireland's second longest and ca 192km long and its catchment area is ca 3,000km^2. It rises on the northeastern slopes of the Slieve Bloom Mountains (max. height ca 505 m) and flows into the Celtic Sea at Waterford Harbour.

7.3.1 Natura 2000 sites

Natura 2000 is an ecological network composed of sites designated under the Birds Directive (Special Protection Areas (SPA)) and the Habitats Directive (Sites of Community Importance (SCI), and Special Areas of Conservation (SAC)).

Best practice guidance (DoE, 2009) recommends that all Natura 2000 sites within 15km of a project be initially screened for impacts.

There is 1 Special Protection Area (SPA) and 4 Special Areas of Conservation (SAC) within 15km of the urban area of Graiguenamanagh as listed in Table 7-1and shown on Figure 7-1.

Table 7-1 Natura 2000 Sites within 15km of the Graiguenamanagh – Tinnahinch Study Area

Type	Site Code	Site Name	County and distance from scheme area
SAC	002162	River Barrow and River Nore SAC	Co. Carlow, Co. Kildare, Co. Kilkenny, Co. Laois Co. Offaly, Co. Tipperary, Co. Waterford and Co. Wexford

Type	Site Code	Site Name	County and distance from scheme area
			0.043 km
SAC	000770	Blackstairs Mountains SAC	Co. Carlow and Co. Wexford 7.32 km
SAC	002252	Thomastown SAC	Co. Kilkenny 12.45 km
SAC	000781	Slaney River Valley SAC	Co. Carlow, Co. Wexford and Co. Wicklow 13.43 km
SPA	004233	River Nore SPA	Co. Kilkenny and Co. Laois 8.78 km

(Data Source: https://www.npws.ie/maps-and-data/designated-site-data/download-boundary-data)

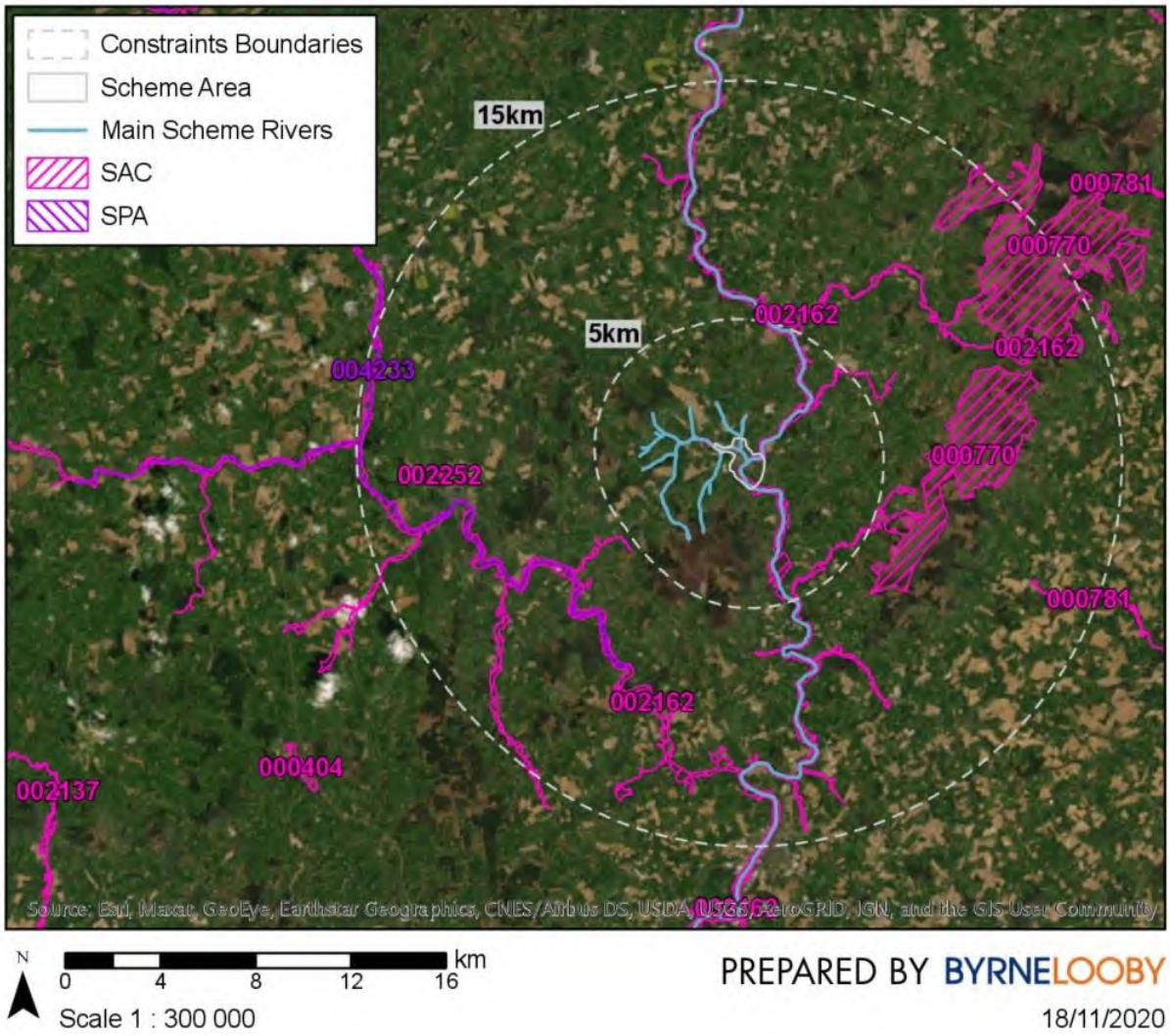


Figure 7-1 Natura 2000 Sites within 15km of Graiguenamanagh-Tinnahinch.

7.3.1.1 River Barrow and River Nore Special Area of Conservation

The great majority of the River Barrow lies within the River Barrow and River Nore Special Area of Conservation (SAC) (site code 002162). This SAC is of high conservation value for

the following Qualifying Interest (QI) habitats and plant and animal species (*denotes a priority habitat):

Habitats

- 1130 Estuaries
- 1140 Mudflats and sandflats not covered by seawater at low tide
- 1170 Reefs
- 1310 *Salicornia* and other annuals colonising mud and sand
- 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- 1410 Mediterranean salt meadows (*Juncetalia maritimi*)
- 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
- 4030 European dry heaths
- 6430 *Hydrophilous* tall herb fringe communities of plains and of the montane to alpine levels
- 7220 Petrifying springs with tufa formation (*Cratoneurion*)*
- 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles
- 91E0 Alluvial forests with *Alnus glutinosa* and Fraxinus excelsior (*Alno-Padion, Alnion incanae, Salicion albae*)*

Species

1029 Freshwater Pearl Mussel (*Margaritifera margaritifera*)

1016 Desmoulin's Whorl Snail (*Vertigo moulinsiana*)

1355 Otter (*Lutra lutra*)

1092 White-clawed Crayfish (*Austropotamobius pallipes*)

1106 Salmon (*Salmo salar*)

1103 Twaite Shad (*Alosa fallax fallax*)

1421 Killarney Fern (*Trichomanes speciosum*)

1990 Nore Pearl Mussel (*Margaritifera durrovensis*)

1095 Sea Lamprey (*Petromyzon marinus*)

1096 Brook Lamprey (*Lampetra planeri*)

1099 River Lamprey (*Lampetra fluviatilis*)

Due to lack of connectivity between the River Barrow and the Thomastown, Blackstairs and Slaney SACs and the Nore SPA, there are no potential pathways for effects to the QIs of these European site nor to the QIs of the Barrow SAC, as such, details of their QI habitats and species are not included in this report.

7.3.2 Natural Heritage Areas and proposed Natural Heritage Areas

There are no Natural Heritage Areas (NHA) within 15km of the site; however, 12 proposed Natural Heritage Areas (pNHA) are within 15 km of the scheme (see Table 7-2).

Table 7-2 proposed Natural Heritage Areas (pNHA) are within 15 km of the site

Site Code	Site Name	County and distance from scheme area
000830	Clohastia	c. 3 km
000770	Blackstairs Mountains (site code) from the study area	c. 6km
000837	Inistioge	c. 8 km
0008444	Murphy of the River	c. 10 km
000812	Pollmounty River Valley	c. 10 km
000698	Barrow Estuary	c. 10 km
000409	Rathsnagden Wood	c. 10 km
000468	Red Bog, Dungarvan	c. 10 km
000410	Thomastown	c. 13 km
000842	Kylecorragh Wood	c. 15km
000827	Brownstown Wood	c. 15 km
000843	Mount Juliet	c. 15 km

Site details and conservation objectives are not listed for these sites on the NPWS website.

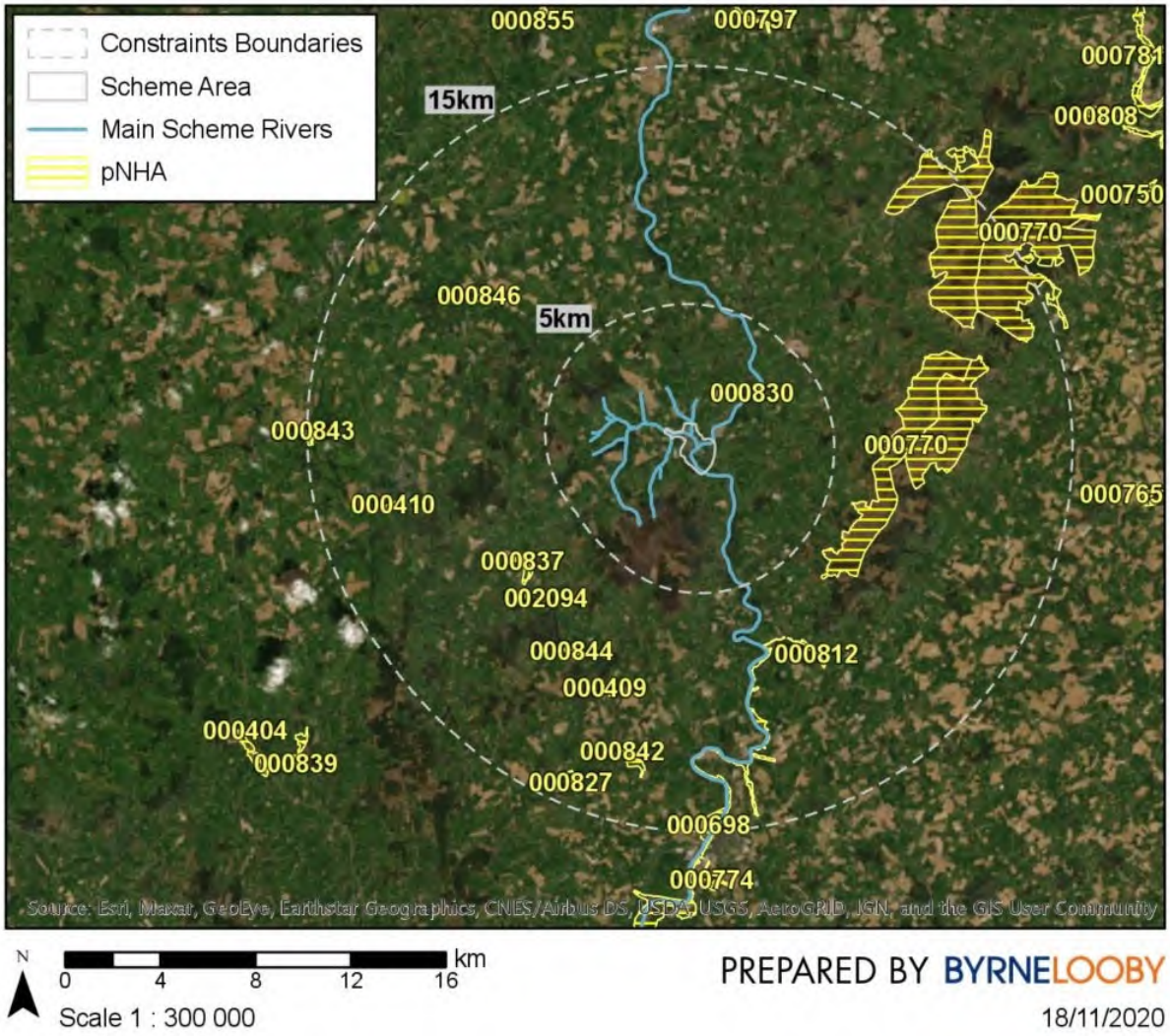


Figure 7-2 Proposed Natural Heritage Sites (pNHAs) within 5km of the scheme area

7.3.3 Protected/Notable Species

Several species of flora and fauna are afforded protection under national, European and international law. At a national level, species are protected under, inter alia, the Wildlife Acts. At a European level, species are protected under, inter alia, the Birds Directive (Council Directive 79/409/EEC) and Habitats Directive (Council Directive 92/43/EEC), which are transposed into national law by various measures including the European Communities (Natural Habitats) Regulations, 1997-2005, and the European Communities (Conservation of Wild Birds) Regulations, 1985. The badger is not considered endangered in Ireland; however, badgers are protected under the Wildlife Acts (Wildlife Act, 1976; Wildlife Amendment Act, 2000), and in Northern Ireland under the Wildlife (N.I.) Order of 1985.

In many cases a derogation licence will be required to remove or disturb these legally protected species or their habitats.

7.3.3.1 Birds

Resident bird species present along the river bank include inter alia, mallard, mute swan, heron, cormorant, wood pigeon, collard dove buzzard, kestrel, sparrow hawk, pheasant, robin, blackbird, song and mistle thrush, blue, great and long tailed tits, magpie, jackdaw, rook, grey crow, raven, moorhen, snipe, chaffinch, green finch, linnet, house and hedge sparrow, long eared owl, sky lark, grey and pied wagtail, starling, gold crest and wren.

Winter visitors include redwing and field fare and summer visitors include amongst other, swallow, swift, house martin, chiffchaff, willow warbler, blackcap and cuckoo.

7.3.3.2 Mammals (non volent)

The desk study data collection exercise confirmed records of otter, badger and fox within the constraints study area (Source: National Biodiversity Ireland website (National Biodiversity Ireland website, 2020)). The paragraphs below provide further information for otter and badger, given the level of protection that they are afforded under Irish and international Law.

No field signs of any other species of mammal were observed during the ecological site walkover.

The study site contains suitable foraging, commuting, breeding and resting habitats for common mammal species in general and similar habitats are also present at a larger scale in the wider landscape. Overall, the proposed site is considered of local importance for mammal (non-volant) species.

7.3.3.3 Otter

The National Biodiversity Data Centre (NBDC) has numerous records of Otter (*Lutra lutra*) (National Otter Survey 2012) occurring within the works scheme area and the species has quite extensive areas of both aquatic and terrestrial habitat for foraging and movement through the site. Otter is listed as vulnerable in the Irish Red Data Book and is fully protected in the State by the Wildlife Act. It is also listed in both Annex II and IV of the EU Habitats Directive and in Appendix II of the Berne Convention.

No holts, resting places or field signs of otter were observed during the ecological site walkover.

7.3.3.4 Red Squirrel

Red squirrel *(Sciurus vulgaris*), though not observed during the ecology walkover survey, has been reported in the area of the scheme since at least 1984 (source: NBDC website). More recently, Lawton et al. (2019) carried out an all-Ireland survey of red squirrel (and also, grey squirrel *(Sciurus carolinensis)* and pine marten (*Martes martes*, discussed in section 7.3.3.5)) and note that records of red squirrel have continued to increase since the previous surveys in 2007 and 2012.

The red squirrel is protected under the Wildlife Act (1976) and Wildlife (Amendment) Acts (2000 and 2010) and the Bern Convention (Appendix III).

Ongoing/regular human disturbance may deter Red squirrel from using the site on a regular basis.

7.3.3.5 Pine Marten

Pine marten (*Martes martes*) has not been recorded as occurring in Graiguenamanagh-Tinnahinch; however, the NBDC records map this species as occurring within ca 10 km of the town. Lawton et al (2019) note that like the red squirrel, pine marten continues to return to areas in Ireland from where it had previously declined.

The pine marten is protected in Ireland by both national and international legislation. Under the Irish Wildlife Acts it is an offence, except under licence, to capture or kill a pine marten, or to destroy or disturb its resting places.

Ongoing/regular human disturbance may deter pine marten from using the site on a regular basis.

7.3.3.6 Badger

No Badger (*Meles meles*) setts or signs of Badger were recorded during field assessments at the study site (e.g. setts, latrines, feeding signs etc.). The National Biodiversity Data Centre (NBDC) has records of badger to the east, northeast, north and northwest of Graiguenamanagh. The adjacent parkland may provide some albeit limited foraging opportunities for Badger (e.g. earthworms and other invertebrates, see Byrne et al. 2012). Ongoing/regular human disturbance, may deter Badgers from using the site on a regular basis.

7.3.3.7 Bats

The bat survey report is provided in Appendix A.

A walkover bat survey was undertaken on the 14th September 2020 with dusk-dawn surveys undertaken 14-16th September the vicinity of the proposed locations of hard defence measures at Graiguenamanagh-Tinnahinch to ascertain if the proposed development area is used, or has the potential to be used, by bats for roosting or foraging. Survey data is supplemented with desk assessment of potential bat habitats in the wider geographical area.

An initial survey of the site during daylight hours was used identify potential roosting sites. Potential sites identified along the survey route are shown in Figure 7-3.

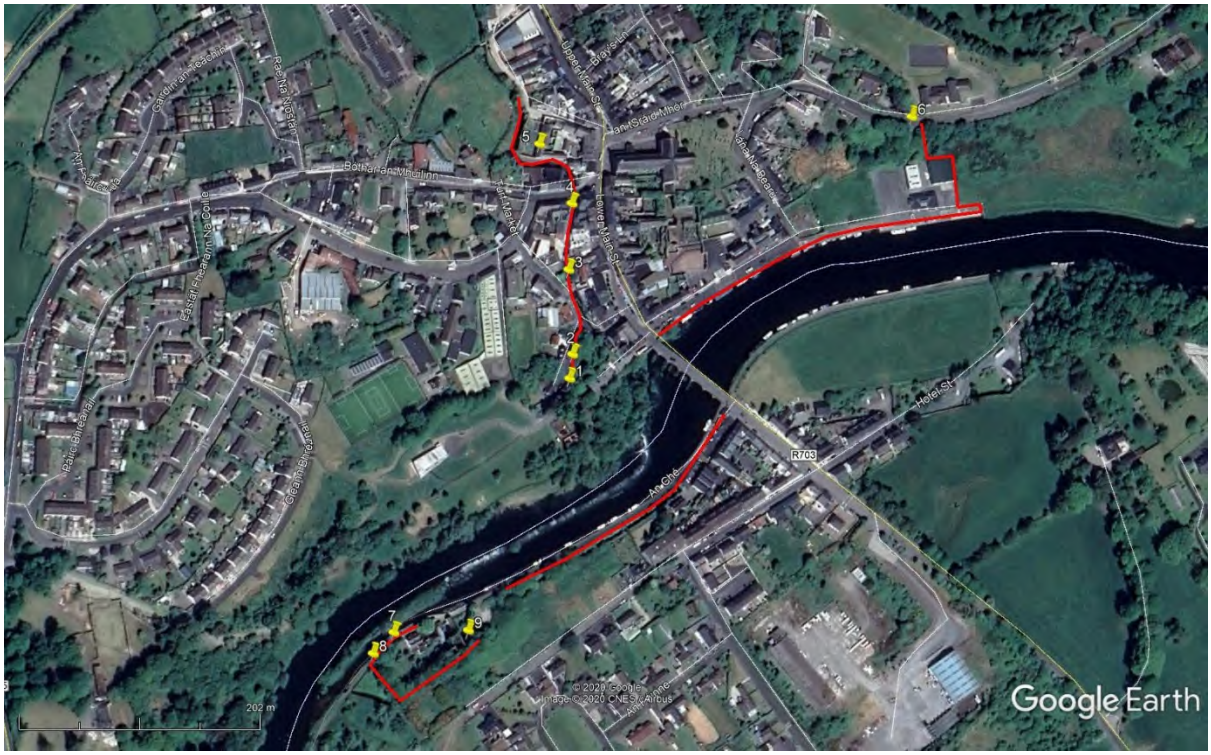


Figure 7-3 Potential bat roosting sites identified from the site walkover

Survey data indicates that bat species (Soprano Pipistrelles) were roosting at a wall in Peg Washington Lane (near Turf Market) and Tinnahinch Castle (sites PR 2 and PR 9 respectively, as shown in the bat survey report):

- During the dusk survey, Soprano Pipistrelles appeared to be circling inside the building (frequent pulses were recorded on detector, suggesting bats were flying past the window). During the dawn survey the following morning, a number of Soprano Pipistrelles (clearest at ~55 kHz, erratic flight patterns) were observed circling before disappearing from view towards the northern end of the building. The exact point of exit/entry was not observed.

- During the dusk survey (observing from inside the castle walls), Soprano Pipistrelles were observed emerging over the top of the northern wall. Some descended into the castle and circled for a short time before leaving. The dawn survey yielded a similar pattern, with Soprano Pipistrelles circling before disappearing from view over the northern wall. The exact point of exit/entry was not observed.

Habitat suitability index data compiled by National Biodiversity Data Centre (NBDC, 2020) for the scheme area (included the proposed flood storage areas) indicates that it is generally of moderate-to-high habitat suitability for bat usage and deemed most suitable for brown long-eared bats and common pipistrelles. This rating is based on the nature of the reasonably diverse surrounding landscape comprised of a mixture of agricultural grassland, silviculture and urban land-uses, which are punctuated by a network of criss-crossing treelines/hedgerows and a river system. The diverse landscape, as well as the presence of ecological corridors in the form of

hedgerows/treelines and rivers are what creates the high habitat suitability index in this area for some bat species.

Records of bat observations compiled by Bat Conservation Ireland have reported five species of bat in Graiguenamanagh-Tinnahinch at the locations shown in Table 7-3 and Figure 7-4 (source: NBDC, 2020).

Table 7-3 Bat observations reported for Graiguenamanagh-Tinnahinch

Location	Species	Date(s) recorded
A	*Myotis daubentonii*	27 times between 2006-2014
B	*Myotis daubentonii*	07/03/2003
C	*Pipistrellus pygmaeus*	08/04/2000
		04/06/2012
	Pipistrellus pipistrellus	04/06/2012
	Nyctalus leisleri	04/06/2012
	Plecotus auritus	04/06/2012
D	*Nyctalus leisleri*	08/03/2000
	Pipistrellus pipistrellus	08/03/2000

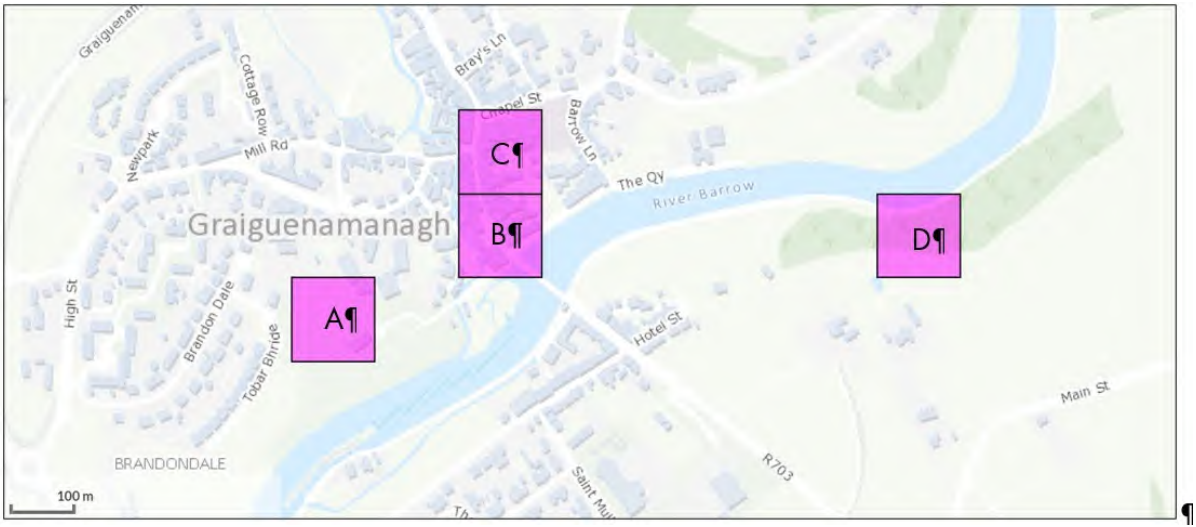


Figure 7-4 Locations of bat observations reported for Graiguenamanagh-Tinnahinch

7.3.3.8 Herpetofauna (reptiles and amphibians)

NBDC hold records for frogs (*Rana temporaria*) in the area around Graiguenamanagh and of newts (*Lissotriton vulgaris*) c. 8 km to the north west of the study area (source: NBDC website).

The Common Frog *(Rana temporaria)* is the only species of frog found in Ireland and is listed as an internationally important species. Frogs are protected under the European Union Habitats Directive and by the Irish Wildlife Act (source: IPCC website).

The smooth newt *(Lissotriton vulgaris)* is the only member of the Urodela (the tailed amphibians) found in Ireland. In Ireland it is an offence to capture, kill or sell a newt, including a newt tadpole, without a licence.

No field signs of any species of reptile or amphibian were observed during the ecological site walkover.

7.3.3.9 Freshwater Fish

The River Barrow is one of Ireland's best coarse angling river fisheries and is a mixed stock fishery containing salmon, trout, pike and several coarse fish species and has excellent stocks of roach, rudd, bream, skimmers, roach-bream hybrids, rudd-bream hybrids, perch and dace. Tench are also present and although seldom reported, carp may also be found on some stretches. Coarse fishing on the Barrow is easily accessible all along the 68km of towpath or by crossing agricultural lands with the permission of the landowners. Access to fishing on the river can also be obtained through a number of angling clubs that control fishing on some sections of this coarse fishery. The Barrow is a wide river, up to 40m wide in places and is generally quite shallow, with a slow to moderate flow. Average depths range from 1 to 3m. (IFI web site).

Fish present in the river include both brook, river and sea lamprey (*Lampetra planeri, L. fluviatilis* and *Petromyzon marinus*) of which river and sea lamprey are migratory, brown trout (*Salmo trutta*), sea trout (*Salmo trutta morpha trutta*), stone loach (*Barbatula barbatula*), three-spined stickleback (*Gasterosteus aculeatus*) and eel (*Anguilla anguilla*). Salmon (*Salmo salar*) which is also a migratory species, has been recorded in the river's lower course (IFI website).

Inland Fisheries Ireland carried out a detailed survey of lamprey in the Barrow (see King, 2006) and one of the main findings of the work was that in conservation management terms, the results are of concern in regard to both *Lampetra* spp. and Petromyzon: the occurrence of a high proportion of negative sites and of sites with low density of Lampetra is a cause of concern as is the very low level of Petromyzon records.

Further surveys are required on site to establish the presence/absence / abundance of the fish species listed above. This will involve netting and electrofishing surveys.

7.3.4 Other taxa

7.3.4.1 Freshwater pearl mussels

Freshwater pearl mussels (*Margaritifera margaritifera*) are present in the river, however, these populations are up stream of Graiguenamanagh. The freshwater pearl mussel is listed as Endangered on the IUCN Red List and is one of the 365 most endangered species in the world. It is protected under the Wildlife Act and Annex II and V of the EU Habitats Directive.

European freshwater pearl mussel populations have declined by 90% over the past century. In Ireland, 27 freshwater pearl mussel populations are protected within Special Areas of Conservation (SACs). Eight of these populations contain 80% of the total Irish freshwater pearl mussel population and are known as the 'Top 8 catchments'. While the 'Top 8 catchments' have some of the highest remaining numbers of freshwater pearl mussels in Ireland, these populations are also undergoing a slow decline, and face extinction unless action is taken.

The main reason for this decline is the low level of survival of juvenile mussels, which are extremely sensitive to slight changes in environmental conditions. This is leading to an ageing population, not capable of replenishing itself. Juvenile survival is dependent on a clean, well oxygenated river bed, with little silt, sediment, or algal growth.

Any activities that result in changes in river flow, increased levels of silt, and increased levels of nutrients are contributing to the decline of freshwater pearl mussels. In addition to drainage, and changes to river channel morphology, increased intensification of land use in river catchment areas can contribute to inadequate conditions for freshwater pearl mussel survival.

There are records of freshwater pearl mussels upstream of Graiguenamanagh-Tinnahinch, as such this species will be considered as the scheme progresses

7.3.4.2 White-clawed Crayfish

White-clawed Crayfish (*Austropotamobius pallipes*) are known to occur in the River Barrow. However, large numbers of dead crayfish were reported in the stretch of the river from Carlow to Graiguenamanagh in 2017. It has been confirmed using DNA analysis that the cause of death was Crayfish Plague. Subsequent outbreaks have been reported (source: 'Crayfish plague' webpage at biodiversityireland.ie)

The white-clawed crayfish is listed on Annexes II and V to the Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive), which means any site considered to be of significance to the species should be designated as a Special Area of Conservation (SAC).

Ireland and Northern Ireland (NI) are considered to be important areas for the conservation of the species as their geographical isolation and current absence of non-native species and crayfish plague potentially give any populations wider conservation implications within the UK and Europe.

The white-clawed crayfish has been classified as Globally Threatened by the International Union for Conservation of Nature (IUCN)/World Conservation Monitoring Centre.

Lowering of river water quality can contribute to inadequate conditions for White-clawed crayfish. White-clawed crayfish vulnerable to crayfish plague (see section 7.4.7.2 for further details).

7.3.5 Aquatic and Terrestrial Site habitats

During the walk over, it was noted that the western river bank below the town is densely colonised by mature trees such as pine, beech and willow (see Figure 7-5).

Flora recorded on the walkover survey included Scot's Pine (*Pinus sylvestris*), Sycamore (*Acer pseudoplantanus*), Willow (*Salix* spp. e.g. *S. triandra, alba, S. Fragilis and S. viminalis*), Holly (*Ilex aequifolium*), Hazel (*Corylus avellana*), Birch (*Betula pubescens*), Beech (*Fagus sylvatica*) (non-native), Ash (*Fraxinus excelsior*), Gorse (*Ulex europaeus*), Nettle (*Urtica dioica*), Bracken (*Pteridium aquilinium*), Red and White Clover (*Trifolium pratense and T. repens*), Vetch (*Vecia*

cracca), Hawthorn (*Crategus monogyna*), Blackthorn (*Prunus spinosa*), Daisy (*Belis perennis*), Chestnut (*Aesculus hippocastanum*), Honeysuckle (*Lonicera* spp.). Bird's foot trefoil (*Lotus corniculatus*), Dock (*Rumex* spp.), Thistle (*Cirsium* spp.), Cleavers (*Geum urbanum*), Iris (*Iris pseudacorus*) Ivy (*Hedera helix*), Perennial rye grass (*Lolium perenne*), Cock's foot (*Dactylus glomerata*), Dandelion (*Taraxacrum* spp.), Knapweed (*Centaurea nigra*), Meadow sweet (*Filipendula ulmaria*), Rush (*Juncus effusus*), Bulrush *(Typha latifolia*), Water Lily *(Nuphar lutea*) (see Figure 7-6).

Characteristic species of the habitat include Meadowsweet, Purple Loosestrife (*Lythrum salicaria*), Marsh Ragwort (*Senecio aquaticus*), Ground Ivy (*Glechoma hederacea*) and Hedge Bindweed (*Calystegia sepium*). Himalayan Balsam (*Impatiens glandulifera*), an introduced and invasive species, is abundant in places particularly in the Duiske River and to a lesser extent in the River Barrow. Japanese Knotweed (*Reynoutria japonica*), another non-native species, was recorded to a lesser extent in the same two water bodies while only one plant of the Giant Rhubarb, Gunnera, was recorded in the Duiske River.

Floating river vegetation in the Barrow include water-starworts (*Callitriche* spp.), Canadian Pondweed (*Elodea canadensis*), water-milfoils (*Myriophyllum* spp.), the pondweed (*Potamogeton x nitens*), Broad-leaved Pondweed (*P. natans*), Fennel Pondweed (*P. pectinatus*), Perfoliated Pondweed (*P. perfoliatus*) and Crowfoot (*Ranunculus* spp) and Club rush (*Scirpus* sp.). Garden escapes included Laurel, Buddleia and Lawson's cypress.

Figure 7-5 Mature trees on western river bank of the River Barrow, Graiguenamanagh.

Figure 7-6 Water Lily pads in the River Barrow upstream of the bridge.

Water quality (as Q values) of the river from 1971 – 1989 was reported to be between 3, 3 to 4 and up to 4 (maximum value is 5) (ERU, 1992) and being described as Medium to Good by the EPA (2018). BOD values for the river are generally low with a maximum of 4.6 mg/l being recorded (ERU, 1998).

In spate conditions after periods of heavy rainfall, the Barrow floods some riparian areas as the river is neither deep nor wide enough to contain the volumes of water that flow through it during such events.

Habitats (*sensu* Fossitt, 2000) present within the study area include:

Table 7-3: Habitats types within and adjacent to the proposed scheme footprint.

Habitat (Fossitt classification)	Study Area
Scrub WS1	✓
Hedgerow WL1	✓
Treelines WL2	✓
Riparian woodland WN5	✓
Buildings and artificial surfaces BL3	✓
Stone walls and other stonework BL1	✓
Spoil and bare ground ED2	✓
Scattered trees and parkland	✓

Habitat (Fossitt classification)	Study Area
Amenity grassland (improved) GA2	✓
Ornamental non-native shrub WS3	✓
Flower beds and borders BC4	✓
Depositing lowland rivers FW2	✓
Canals	✓
Drainage ditches FW4	✓

No botanical species protected under the Flora (Protection) Order 2015, listed in Annex II or IV of the EU Habitats Directive (92/43/EEC), or listed as species of conservation concern in Ireland were recorded for the study site. All species recorded during the botanical survey are considered common for similar habitats in the general area.

7.3.6 Invasive species

Currently, Regulations 49 and 50 of the European Communities (Birds and Natural Habitats) Regulations 2011 make it an offence to: plant, disperse, allow dispersal or cause the spread of a number of non-native 'invasive species' including Japanese knotweed, Himalayan balsam and *Gunnera*.

A walkover survey to identify and record the occurrence of non-native invasive species was undertaken on the 8th September 2020. Japanese Knotweed, Himalayan balsam and Gunnera have been identified as present within the public realm areas in the study area.

An invasive species treatment and management plan has already been implemented.

7.4 Key Constraints

7.4.1 Protected Sites

The most significant ecological constraint at Graiguenamanagh is the River Barrow and River Duiske, given their status as an SAC (the River Duiske is part of the River Barrow and River Nore SAC). For this reason, any works that are to be carried out to reduce flooding must take this sensitivity into account. Where at all possible, any in-river works should be avoided and every effort must be made to minimise, if not avoid, any run off to it.

All work that is to be carried out on the river bank must be carried out in such a way as to minimise the potential for events such as diesel or concrete spillages, run off of water with suspended sediment loadings or any accidental spillages. If it considered necessary to re-build weirs or sluices, the same sort of construction approach should be designed in to minimise resuspension and loss of concrete to the river.

Appropriate Assessment under Articles 6(3) and 6(4) of the EU Habitats Directive (Directive 92/43/EEC) will be required for the proposed scheme.

7.4.2 Protected/notable Species

In ecological terms, the river corridor (including the river itself) supports a number of protected species including two species of lamprey, salmon, sea and brown trout, otter, bats, badger, and potentially red squirrel, pine martin, white-clawed crayfish and the common frog.

Any in-river and bankside works have to be designed to minimise potential impacts on these (and all other) species.

All works should be planned wherever possible to be carried out at times of the year that are ecologically least sensitive e.g. outside bird nesting (March – September) and fish migration periods (Spring/Summer, depending on species).

7.4.3 Otter

The ecological study area contains suitable commuting, foraging, breeding and resting habitats for otter, although it should be noted that no holts or field signs of otter were recorded during the ecological walkover survey. Desktop study indicates that otters have previously been reported as occurring in the vicinity of the scheme. As a European protected species, the otter is fully protected under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). Any scheme option that may have the potential to disturb otters must be assessed. A full otter survey will be completed once the scheme extents are known. If otters are found to be present and disturbance is likely then KCC must apply for a licence to allow proposed development works that might affect otters to proceed legally. The potential impacts on otter will be assessed and reported in the EIA.

Otter mitigation works can potentially be conducted at any time of year but must avoid the breeding season (usually Spring but can be any time of year) if holts are present on site.

7.4.3.1 Red Squirrel

Although red squirrel have been recorded in the study area, no dreys or field signs were recorded during the site visit. Construction work is very unlikely to threaten red squirrel as no drey sites were recorded within the proposed scheme area.

Pre-construction surveys would be undertaken for all suitable habitat that will be impacted by the proposed scheme. Should any drey be confirmed as having red squirrel present, works would cease in the vicinity of the drey, and discussion would be held with NPWS to determine the most appropriate course of action including possible erection of artificial nesting sites within suitable retained vegetation.

Should a drey be recorded within the scheme extents prior to construction works then appropriate mitigation and a licence for works will be required. Works affecting red squirrel habitat should be timed to avoid the breeding season (1st February – 30th September inclusive); and protection zones of a minimum of 5 m or one tree buffer should be employed around active dreys.

7.4.3.2 Pine Marten

Although pine marten have been recorded in the study area, no breeding or resting places or field signs were recorded during the site visit. Construction work is very unlikely to threaten pine marten as no den sites were recorded within the proposed scheme area.

Pre-construction surveys would be undertaken for all suitable habitat that will be impacted by the proposed scheme. Should any breeding or resting places be confirmed as having pine marten present, works would cease in the vicinity of the location, and discussion would be held with NPWS to determine the most appropriate course of action including the provision of artificial den boxes in suitable adjacent habitat.

Should a den be recorded within the scheme extents prior to construction works then appropriate mitigation and a licence for works will be required. Works affecting pine marten habitat should be timed to avoid the breeding season (March - June inclusive); and protection zones of a minimum of 5m buffer should be employed around active dens.

7.4.4 Badgers

Although badgers have been recorded in the study area, no setts or field sign were recorded during the site visit. Construction work is very unlikely to threaten badger as no setts were recorded within the proposed scheme area.

Pre-construction update surveys would be carried out to maintain the validity of species data. The results of these would inform the decision as to whether to close a sett through exclusion or to destroy it if it is no longer active. Alternative locations for artificial setts would also be scoped in these updates. Surveys would be carried out in accordance with best practice guidance.

Should a badger sett be recorded within the scheme extents prior to construction works then appropriate mitigation and a licence for works will be required. Construction of new setts must be completed in Spring/Summer with blocking and destruction of existing setts completed in Autumn/early winter.

7.4.5 Bat

The scattered mature trees, bridges, architecture (churches, masonry) and areas of low water flow provide good foraging, roosting and commuting routes for bat species in the area. Options that require the removal of mature trees or works to bridges or other riverine structures with the potential to support roosting bats shall be assessed for bat potential. Bat surveys shall be conducted on any features with medium or high potential for roosting bats.

Once more detail becomes available pertaining to the proposed structural alterations to the site (including the proposed methods of construction), the site should be re-visited for the purpose of:

- Surveying key locations (e.g. where it is known that potential roosting habitat will be removed or disturbed); and

- Obtaining more detailed information about any potential bat roosts (i.e. whether it is a maternity roost, hibernaculum etc.)

This information will inform any considerations of mitigation measures that may need to be implemented. The optimal time to conduct map surveys are May and August, when bats are most active. If bats are found, they should not be disturbed during hibernation period (October to March) or maternity period (June to August). If a bat roost requires removal, then a licence would be required. Removal of roosts should be carried out during the summer months for hibernation roosts and during the winter months for maternity roosts.

As all Irish bats and their roosts are protected under national and EU legislation it is an offence to disturb or interfere with them without a licence. Such a derogation (which must be given by the Minister for the Environment, Heritage and Local Government) can only be sanctioned where there is no satisfactory alternative and where it will not be detrimental to the favourable conservation status of the species concerned. Therefore, any felling of trees or work on bridges which provide suitable roost habitat for bats should be sought in advance of any development that may interfere with such roost sites.

7.4.6 Freshwater Fish

Fish present in the river include both brook and river lamprey (*Lampetra planeri* and *L. fluviatilis*), brown trout (*Salmo trutta*), sea trout (*Salmo trutta morpha trutta*), stone loach (*Barbatula barbatula*), three-spined stickleback (*Gasterosteus aculeatus*) and eel (*Anguilla anguilla*). Salmon (*Salmo salar*) have been recorded in the river's lower course. Further surveys are currently being competed on site to establish the presence/absence/abundance of the fish species listed above. This will involve netting and electrofishing surveys.

In terms of the construction programme, it should be noted that in salmonid catchments, in-stream works are not permitted between the months of January to April (migration) and October to December (spawning). This corresponds with guidance from Inland Fisheries Ireland (Murphy, 2016).

Lamprey (both species) spawning takes place in the spring and early summer period in often the same habitats where salmon and trout spawn (O'Connor, 2017). The spawning season for brown and sea trout is November to February. If spawning grounds are found to be present in the construction zone for the scheme then this period should be avoided.

A full impact assessment and management plan for these fish species will be produced as part of the EIA report once full scheme details (including construction methods) are known.

7.4.7 Other taxa

7.4.7.1 Freshwater pearl mussel

Freshwater pearl mussels are present in the river, however, these populations are up stream of Graiguenamanagh. Any impacts that result in a decrease in anadromous salmonid populations (Atlantic salmon and sea trout) could have a significant impact upon the viability of the freshwater pearl mussel population. The lifecycle of freshwater pearl mussel is reliant upon the development of glochidia which that attach to the gills of host fish, usually juvenile salmonids, to continue development (Skinner et al., 2003). Therefore, a decline in the salmonid population within the River, as a result of construction and operational disturbance to migration, could have an impact upon the future viability and population size of freshwater pearl mussel. Works therefore should be carried out outside the period when salmon are migrating either upstream to breed or when fish return to the sea as smolts or adults.

7.4.7.2 White-clawed Crayfish *(Austropotamobius pallipes)*

Any works carried out on the riparian habitat and banks should where possible be restricted to between July and October as this is a period when white-clawed crayfish are less sensitive, with females already having released their young and individuals being more active and not seeking refuge deep in bankside burrows as they do in winter months. Pre-construction surveys may be required, depending on the extent and location of the proposed measures.

7.4.7.2.1 Biosecurity (Crayfish Plague)

Crayfish Plague (a water-mould *Aphanomyces astaci*) has previously been reported in waterways the vicinity of the scheme area with periodical outbreaks occurring within different locations with the catchment. The plague can be spread by moving equipment that has been used in an affected area to an unaffected catchment and strict biosecurity measure will need observed when working in affected catchments. Prior to any in river works during construction the NPWS should be contacted to confirm the status of any outbreaks in the rivers and suitable biosecurity measure should be put in place (e.g. 'Check, Clean, Dry' protocol prior and after any in river works) (source: Information note issued by National Parks, and Wildlife Service, Department of Culture, Heritage and the Gaeltacht and Marine Institute, August 2019).

7.4.8 Invasive Species

Japanese Knotweed, Himalayan balsam, and Gunnera are listed as invasive plants under the EC (Birds and Natural Habitats) Regulations 2011 (S.1. 477/2011). These regulations prohibit the introduction or dispersal of invasive species and appropriate measures should be undertaken in the proposed scheme development. Therefore, any works occurring in areas where invasive species are present must use appropriate measures. An invasive species treatment and management plan has already been implemented.

8 Cultural Heritage and Archaeology

8.1 Introduction

This section assesses and evaluates the potential cultural heritage and archaeology (consisting archaeological and build heritage) constraints of the study area.

For the purposes of this report, the constraints study area is defined as the area outlined in Figure 8-1. All the cultural heritage constraints within the scheme area are considered. Further focus was given to the designated heritage assets which are present within 100m of each river, as this area is most likely to be potentially physically affected by the proposed works.

Figure 8-1 Constraints boundary for cultural heritage and archaeology

The study area includes townlands of Tinnapark, Ballynakill, Graiguenamanagh, Bohermore, Newtown, Brandondale, Tinnahinch, and Coolfarnamanagh. The Duiske River and a millrace associated with the historic milling of the town run through Graiguenamanagh on the western side of the main street and issues into the Barrow at Turfmarket downstream of the bridge.

8.2 Methodology

Constraints were determined through a desk study and a preliminary field inspection. The assessment involved the compilation and mapping of available cultural heritage data sets. This forms a permanent renewable database that can be utilised by multiple specialist users to provide information for the project design and EIA process. At the time of writing desktop data regarding industrial heritage was not available and this constraints study has been drafted based on data considered sufficient for the purpose of establishing the high-level constraints.

A review of the following information took place in order to inform the cultural heritage report:

- UNESCO World Heritage Sites (WHS) and Tentative World Heritage Sites and those monuments on the tentative list;
- National Monuments in State care, as listed by the National Monuments Service (NMS) of the Department of Culture, Heritage and the Gaeltacht (DCHG);
- National Monuments Sites with Preservation Orders Sites;
- Sites listed in the Register of Historic Monuments;
- Record of Monuments and Places (RMP) and the Sites and Monuments Record (SMR) from the Archaeological Survey of Ireland;
- A review of artefactual material held in the National Museum of Ireland;
- The Kilkenny Development Plan (2014-2020), Carlow Development Plan (2015-2021). The Graiguenamanagh Local Area Plan (under review) and Tinnahinch Local Area Plan (2010-2016). These plans were consulted for the record of Protected Structures (RPS) and was consulted for the record of Conservation Areas and Architectural Conservation Areas (ACA's). A joint Local Area Plan Graiguenamanagh – Tinnahinch Local Area Plan (2020) is being developed and is at pre-draft consultation stage;
- National Inventory of Architectural Heritage (NIAH) Building Survey (NIAH ratings are international, national, regional, local and record, and those of regional and above are recommended for inclusion in the RPS);
- National Inventory of Architectural Heritage (NIAH) Garden Survey (paper survey only);
- Cartographical Sources, OSi Historic Mapping Archive, including early editions of the Ordnance Survey including historical mapping (such as Down Survey 1656 Map); Historical maps including the Down Survey, and the first and revised editions of 6 Inch and 25 Inch Ordnance Survey maps;
- The Irish archaeological excavations catalogue i.e. Excavations bulletin and Excavations Database;
- Place names; Townland names and toponomy (loganim.ie);

- National Folklore Collection (Duchas.ie);
- A review and interpretation of aerial imagery (Google earth 2001–2019, Digital Globe 2011-2013, Bing 2019) to be used in combination with historic mapping to map potential cultural heritage assets;
- Collation of information from similar or other infrastructure projects, for example EISs, SEAs, conservation plans, archaeological test assessments and excavations; and
- A review of existing guidelines and best practice approaches.

A preliminary field inspection was carried out on the 3rd October 2020. Its aim was to establish the general character of the study area. It is noted that the potential locations of the proposed flood storage areas were not available at the time of the survey and were not visited during the preliminary field inspection. However, these areas have been considered as part of the desktop baseline assessment and further site visits will be undertaken for the EIA, if required.

The ongoing assessment will include field assessment focused on the proposed flood relief options when they have been devised and consultation with statutory and non-statutory bodies. All relevant designated heritage assets will be mapped in preparation for the field assessment stage and inventories of all relevant heritage constraints will be prepared. The evaluation process ensures that all designations relating to heritage assets as well as cultural heritage features that are revealed through research, field assessment and consultation are clearly articulated.

8.3 Baseline / Receiving Environment

8.3.1 Historic Culture of the Study Area

8.3.1.1 Prehistoric Period (c. 7000 BC- 400 AD)

The study area is situated at the edge of a river and the base of a substantial summit, which would have made it a hotspot of prehistoric activity. Rivers in general are typically areas of dense prehistoric activity, due to the availability of food resources, and it is common to find early settlements and cooking sites within riverine locations. The study area is additionally situated at the intersection of the River Barrow and the base of Brandon Hill, which attracts further attention to the area. Whilst there are no prehistoric sites recorded in the study area, several cairns (KK029-032001, KK033-008002, KK033-015), a standing stone (KK029-043), rock art sites (KK033-050, CW022-046, CW022-073), hillfort (KK033-008001), several undated hut sites (KK033-049; KK033-006001), and a number of other sites have all been found within 8km of the study area in the surrounding mountains and high points. The cairns, standing stone, and rock art sites indicate a firm and visible monumental presence in the area dating back to at least the Bronze Age, and possibly even the Neolithic.

8.3.1.2 Duiske Abbey and the development of Graiguenamanagh

The former Cistercian abbey of Duiske (RMP KK029-01801) in the centre of the town of Graiguenamanagh provided the focus for the latter's development, as the town evolved

gradually around the abbey. The abbey gave the town its name, which translates as 'the grange of the monks'. The name of the abbey itself, which means 'of the water or rivers', refers to the location of the abbey near the Duiske tributary, at the confluence of the Blackwater River and the Barrow River (Anon. 1892).

The Cistercian abbey of Duiske was established in the early years of the thirteenth century by a group of Cistercian monks from Stanley in Wiltshire. Duiske Abbey is the largest example of a Cistercian abbey built in Ireland (Carville 1979). The abbey church was built in a slightly elevated area which overlooks the tributary of the River Barrow and a small stream, the Duiske (an Dubhuisce - dark water). Generally Cistercian abbeys in Ireland were built as near to water as possible, on a solid foundation, which was necessarily above flood level. The abbeys required water for both domestic use and as a power source for their mills, and sophisticated water management and use of waterpower are identifying characteristics of Cistercian houses across Europe.

A number of burials (KK029-01806) were uncovered at the junction of Chapel Street and Barrow Lane in road widening and repair schemes in the mid-nineteenth century and onwards. According to a local man, the burials had been aligned north-south instead of the usual east-west orientation associated with Christian burials. However, their close proximity to Duiske Abbey graveyard may suggest that the original graveyard extended in an easterly direction beyond the present boundary.

8.3.1.3 Other Archaeological Features

The town centre of Graiguenamanagh is designated as a Zone of Archaeological Potential (ZAP, RMP Ref: KK029-048).

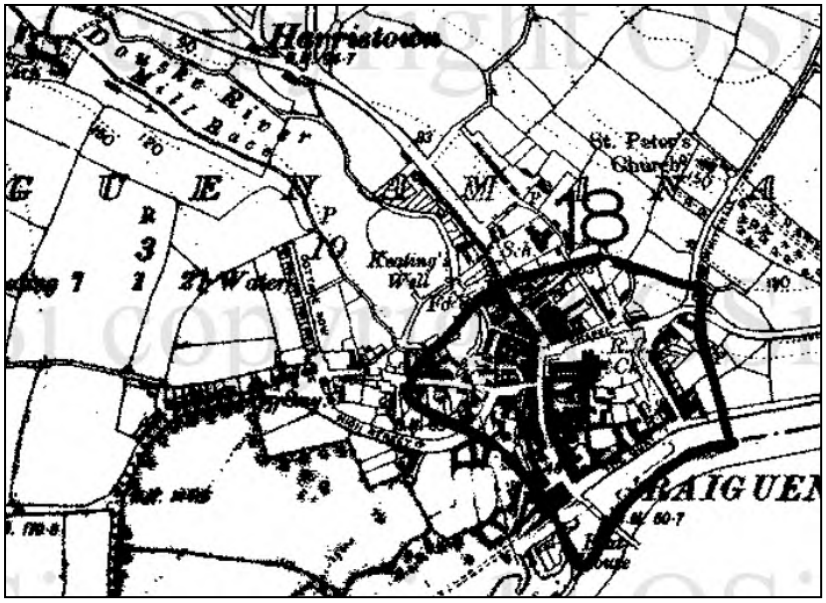


Figure 8-2: RMP Zone of archaeological Potential around the medieval town of Graiguenamanagh.

This zone contains a number of upstanding recorded archaeological monuments or sites of monuments that have long since disappeared, within this zone there is an increased potential

that archaeological activity associated with the medieval development of the town survives below ground or survives as medieval fabric that has been reused or integrated into the upstanding structures within the town.

North of High street there is a clapper bridge (RMP KK029-018007, RPSD153, Figure 8-14) spanning a shallow point of the Duiske River just north of where the tail race of the former monastic mills joins it from the south. It is a simple, narrow, originally five-span bridge (length: 24m across the river, average width: 0.6m) constructed of local rough-cut granite lintels mounted two abreast on granite upright supports. The bridge may have been associated with Duiske Abbey (KK029-018001). The bridge is unfortunately damaged. On the western side of to the millrace in the slope is a natural spring that was a venerated holy well (KK029-01807) known as Lady's Well. The spring is visible under a stone lintel, a stone wall has been erected around it in a semi- circle around the opening. They often are reputed to possess miraculous healing properties. These may have their origins in prehistory but are associated with devotions from the medieval period (5th-16th centuries AD) onwards, it is very likely associate with the abbey.

Figure 8-3: The clapper bridge spanning the River Barrow adjacent to a former mill (left) and Lady's Well with mill race to the left (right), Graiguenamanagh

There is another well (undesignated) on the northwestern outskirts of the town known as Keeting's well, located on the western banks of the Duiske River (at a former fording point) (Figure 8-4). The spring is surrounded by a rubble stone and cement wall with steps leading into the well. There is no indication if the well was ever venerated.

Figure 8-4: Keeting's Well, Graiguenamanagh

West of the above mentioned mill race, fronting the High Street there is a large mill complex, a former grain mill that had converted to the shipping and weaving of wool, trading as Cushendale Woollen Mills (Hammond, 1990 389). It lies on the site of the monastic mill. There is potential that some of the earlier fabric may exist within the structure (Figure 8-5).

Figure 8-5: Cushendale Woollen Mills on the site of the monastic mills (left) and Detail the rubble fabric within it (right).

The town developed further in the late eighteenth century, influenced by the growing importance of the Barrow River as a trade route. By the early nineteenth century, the site of the monastic buildings was largely occupied by dwellings of the town (Figure 8-7).

Figure 8-6: OS mapping (1839) showing the Abbey remains and site encroachment in the 19th century

Figure 8-7: View of the abbey from Graiguenamanagh Bridge (left) and Abbey Church (right)

Many of these houses were most likely constructed using parts of the Duiske Abby walls, this is confirmed by the structural remains that have recently been exposed and are presented in a car park (Figure 8-8).

Figure 8-8: Views of the ruins preserved in the Supervalu Car Park north of the Quays

Graiguenamanagh bridge (RPS CW496 & C125, RMP CW024-029 & KK029-042) was constructed in the area prior to 1640 and partially demolished following the Battle of New Ross and subsequently rebuilt. It was rebuilt again following the "Great Flood" of 1763 and, in the again, after the Cromwellian wars. It comprises a seven-arch shale-built hump-back road bridge over river (Figure 8-9). This elegantly-composed bridge was built to designs prepared by George Smith (fl[3]. 1763-7), a pupil of George Semple (fl. 1753-82), forming an attractive landmark at a crossing (NIAH files), it has been described as one of the most elegant bridges in the country (O'Keeffe, Simington, & Goodboy, 2016).

Figure 8-9: George Semple/Graiguenamanagh Bridge west elevation

[3] Floruit (/ˈflɔːrjʊɪt/), abbreviated fl. (or occasionally flor.), Latin for "he/she flourished", denotes a date or period during which a person was known to have been alive or active.

The views from the bridge show the relationship that both Graiguenamanagh and Tinnahinch has to the river (and Figure 8-11).

Figure 8-10: Panoramic view of the Quay taken from the southern banks of the barrow east of Graiguenamanagh Bridge (view upriver)

Figure 8-11: Panoramic view of Tinnahinch from the western side of Graiguenamanagh Bridge (view downriver)

8.3.1.4 The medieval development of Tinnahinch

Tinnahinch Castle (CW024-026) located on the River Barrow adjacent to Lock 20, was built in 1615 by James Butler. It was an important defensive measure in the prolonged struggle between the Butlers and the Kavanaghs in order to control access to a wooden bridge (KK029-042), built in 1540, that served as a link between Tinnahinch and Graiguenamanagh.

It comprises a rectangular building (10.7m N-S, 6.9m E-W) of three storeys, with stair tower at southwestern corner. There is a bartizan at northeastern corner of main tower. A deer park associated with the castle was also constructed on Brandon Hill.

Approximately 330m to the south west of the castle is a church and graveyard in Tinnahinch (CW024-027). It is marked on the 1837 OS map as St Michael's Church (in ruins) and is depicted as being within a circular enclosure (Figure 8-12). It is sited in an elevated position, possibly on a rock outcrop in otherwise very low-lying land overlooking the river Barrow to the west (Figure 8-12). Approximately 180m to the south-southeast of the church is a holy well, St.

Michaels Well (CW024-028). The RMP indicates that the well is protected by a corbelled dome, it is located in a low-lying flood plain in an overgrown area and is difficult to locate.

Figure 8-12: The church and holy well on the First ed. OS map 1837 and View north towards St Michael's church from the canal tow path

8.3.1.5 Seventeenth century map depictions

Historical maps of the scheme area hold scant details and record the abbey and a number of smaller structures, they also show a bridge over the River Barrow and the Duiske tributary, with a possible mill(s) and a structure that may be a weir. Tinnahinch is shown as having a castle and a 'stone bridge' over the River Barrow. The castle is noted to be in repair and a stone bridge is noted as connecting Tinnahinch to Graiguenamanagh over the River Barrow.

8.3.1.6 Post-Medieval Development of the Study Area

Industrial Development (Mills and manufacturing)

The River Barrow at Graiguenamanagh/Tinnahinch has a long history of milling, dating back to the 13th century with the establishment of Duiske Abbey. Milling intensified during the 18th and 19th centuries due to the construction of the Grand Canal and Graiguenamanagh became an important port on its route. Shipping and milling were successful in the area until the establishment of roadways in the 1950s, when it was rendered obsolete and was ultimately closed.

Graiguenamanagh first saw an immense increase in size and growth during the 18th century, and as revealed by the historic sources and maps, manufacturing industries predominated in the town with numerous manufacturing mills developed along the River Barrow and the Duiske, including wool, barley, corn, and flour mills. Additional industries of textile production in the town were, and still are, conducted by the Cushon family, who a rented mill in the St Mullins and later purchased one of the original monastic mills, dating to the 11th century, in 1925.

The River Duiske played a significant role in the industrial development of Graiguenamanagh in the 18th and 19th century that can be observed today through the buildings, remnants of mills and footbridges along the river and through the town.

A complex of surviving mill buildings, known as Doyle's Woollen mills, is located across from the abbey within the centre of the town.

There was a starch works and mill race in Tinnahinch on the western side of the bridge, it was developed in the late 19th century. Mill structures survive adjacent to modern buildings and very likely to the rear of these buildings along with its mill race. The mill race runs parallel to the canal and then runs to rear of Tinnahinch Castle and canal lock house and flows into the River Barrow crossing a footbridge carrying the canal tow path (Figure 8-13).

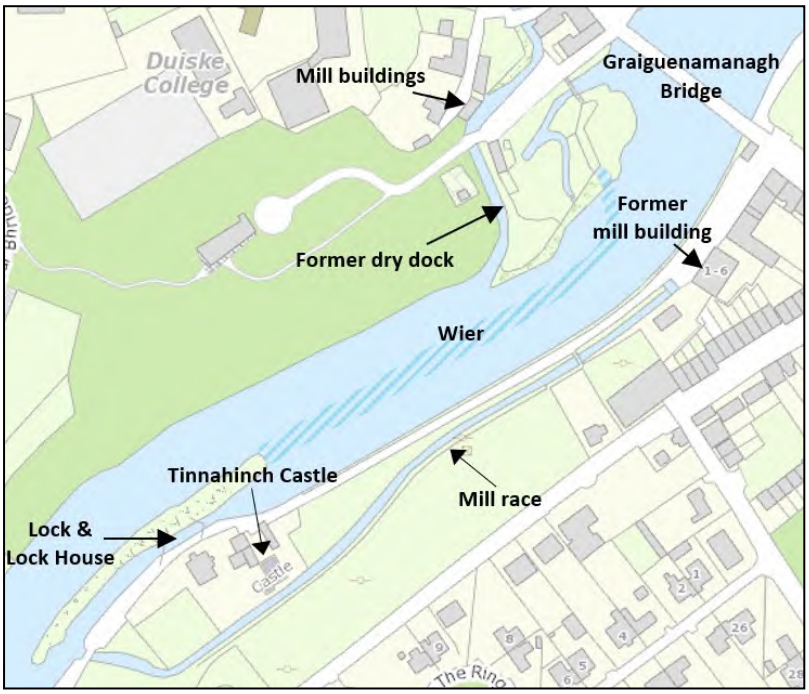


Figure 8-13: Features west of Graiguenamanagh bridge

Transport

The development of the Barrow Navigation also bolstered the town's industrial development and, by the 1780s linked the River Barrow and the South-East region with the Grand Canal and Dublin.

On the northern banks of the Barrow to the west of the bridge is the silted-up remains of former dry dock, the sidewalls of which are still visible, a former boat house, a foot bridge and weir. There are also industrial buildings and a footbridge over the Duiske River, and ruined structures leading down to the former dock.

The present quay structure dates to the 18th century, and prior to its construction the original riverbank was probably situated much nearer the abbey precinct.

On the opposite side of the river in Tinnahinch the river is bound by green fields. There is a milestone (undesignated site) marking the river, it has a benchmark on it, but the carved detail is worn away.

The advent of railways in the mid-19th century signalled the beginning of the decline of the canals for foot passenger transport and by 1852 only trading boats remained on the canals. Trade along the Barrow was relative successful and efficient until the development of road transport. In 1950 the Grand Canal Company was taken over by CIE and all barges were withdrawn from the canal in 1959. The waterway is now a significant amenity.

8.3.1.7 Previous excavations

There have been several archaeological excavations within the study aera, with surveys focused on Graiguenamanagh ZAP and in the vicinity of Duiske Abbey. These have produced evidence of industrial activity occurring within the town during the 18th and 19th centuries along with the remains associated with Duiske Abbey. Multiple burials and structural features of Duiske Abbey were uncovered during excavations along with floor tiles. The excavations and investigations are summarised in Appendix B.

8.3.1.8 Stray Finds

There are four small finds noted within the study area, all of which are tiles that relate to the structure of Duiske Abbey. These finds (NMI Ref: 1936:1913; 1986:89; 1986:88; 1986:86-87 A-D) are fragments of floor, roof, and encaustic tiles laid during the initial construction of Duiske Abbey. As described above there is a record of skeletons (NMI Ref: 1931) identified on Chapel Street by workmen during the laying of pipes in connection with the new water works. It appears that the Abbey graveyard extended over the present roadway before Chapel Street came into existence.

8.3.2 Designated Heritage Constraints

8.3.2.1 World Heritage Site

There are no World Heritage Sites in the study area nor are there any sites contained in the tentative list of candidate Sites.

8.3.2.2 National Monument, and Preservation Order sites

There is one National Monument within the study area boundary, Graiguenamanagh (Cistercian) Abbey (Duiske) Abbey which is in the ownership of the State (KK029-018001-620), it is also on the list of National Monuments with a preservation order (1/1968).

8.3.2.3 Record of Monuments and Places and Sites and Monuments Record Sites (RMP / SMR sites) and Zone of Archaeological Potential (ZAP)

The Record of Monuments and Places (RMP) of the DCHG records known upstanding archaeological monuments, their original location (in cases of destroyed monuments) and the position of possible sites identified as cropmarks on vertical aerial photographs. Archaeological sites identified since 1994 have been added to the non-statutory SMR database of the Archaeological Survey of Ireland (National Monuments Service, DCHG), which is available online at www.archaeology.ie and includes both RMP and SMR sites. Those sites designated as

SMR sites have not yet been added to the statutory record but are scheduled for inclusion in the next revision of the RMP.

The Graiguenamanagh historic town Zone of Archaeological Potential (ZAP) (KK029-018) is located in the study area. The zone outlines the areas of specific archaeological interest within town. There are sixteen recorded archaeological monuments within study area boundary (Table 8-1 and Figure 8-14) of these four are located outside of the ZAP on the Tinnahinch side of the River Barrow.

Table 8-1: RMP sites within the proposed development area

Map No.	RMP Number	Site Type	Townland	ITM
01	CW024-026—	Castle - tower house	Tinnahinch, Carlow	670739, 643415
02	CW024-027001-	Church	Tinnahinch, Carlow	670895, 643070
03	CW024-027002-	Graveyard	Tinnahinch, Carlow	670889, 643070
04	CW024-028—	Ritual site - holy well	Tinnahinch, Carlow	670926, 642846
05	CW024-029— & KK029-042—	Bridge	Tinnahinch, Carlow Brandondale, Kilkenny	670661, 643442 670661, 643442
06	KK029-018—	Historic town	Graiguenamanagh, Kilkenny	670854,643824
07	KK029-018001-	Religious house - Cistercian monks	Graiguenamanagh, Kilkenny	670919, 643782
08	KK029-018002-	Cross - High cross (present location)	Graiguenamanagh, Kilkenny	670925, 643809
09	KK029-018003-	Tomb - effigial	Graiguenamanagh, Kilkenny	670887, 643828
10	KK029-018004-	Wall monument	Graiguenamanagh, Kilkenny	670901, 643821
11	KK029-018005-	Cross	Graiguenamanagh, Kilkenny	670901, 643821
12	KK029-018006-	Burial	Graiguenamanagh, Kilkenny	670976, 643871
13	KK029-018007-	Ritual site - holy well	Graiguenamanagh, Kilkenny	670772, 643828
14	KK029-018008-	Clapper bridge	Graiguenamanagh, Kilkenny	670783, 643831
15	KK029-018009-	Water mill - unclassified	Graiguenamanagh, Kilkenny	670741, 643814
16	KK029-018012-	Cross - High cross	Graiguenamanagh, Kilkenny	670922, 643808

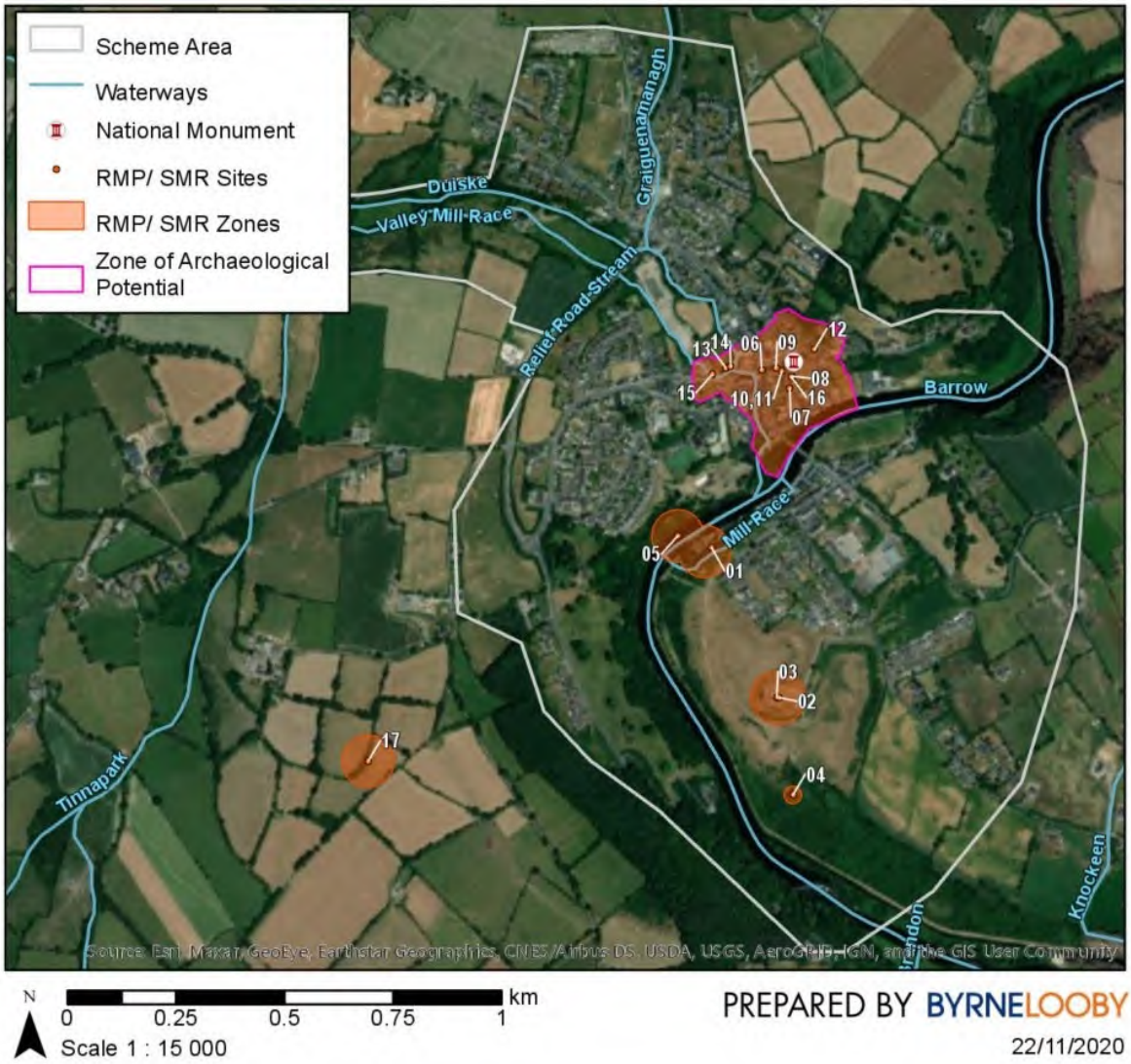


Figure 8-14 RMP / SMR sites within the constraints study area for archology and cultural heritage

8.3.3 Architectural Heritage

Described within section 8.3.1.

8.3.3.1 Architectural Conservation Area (ACA)

Graiguenamanagh is an Architectural Conservation Area (ACA) (Figure 8-15). The ACA has been defined in order to ensure the preservation of character of the traditional townscape, while promoting appropriate new development as opportunities arise in a manner that respects and reinforces the special character.

It is an objective of the Council to preserve and enhance the character of the town centre by protecting historic buildings, groups of buildings, the existing street pattern, plot sizes and scale, while encouraging the development of appropriate mixed-use development where suitable in the town centre.

The ACA character appraisal for Graiguenamanagh is as follows in the Local Area Plan (2009-2020):

Duiske Abbey and its adjoining graveyard, together with the narrow and in places winding streets of the town centre, their interconnection with the Abbey, and the relationship of the River Barrow, gives Graiguenamanagh a unique visual character. The compact form of Main Street, containing many traditional three and four storey buildings with ground floor shops and businesses, contrasts with the higher buildings of various types and the open waterfront character of The Quay. The traditional features of buildings in the town centre contribute to its coherent townscape character, such as consistent roof profiles, roof coverings, chimney stacks, rendered facades, door and window proportions and surrounds, and decorated shop and pub fronts. The medieval core of the town is complemented by the presence of the River Duiske and Mill Race running to the rear and sometimes beneath properties on Main Street, the Turf Market and Lady's Well, with its remnants of industrial archaeology that includes former warehouses, mills and a dock.

The Council considers that the medieval core of the town, and incorporating the industrial heritage of the Turf Market and Lady's Well, has special architectural and townscape qualities which derive from the traditional layout, design and unity of character of the area, such that the inclusion of the area in an ACA is necessary for the conservation of its special character.

8.3.3.2 Record of Protected Structures (RPS)

There are thirty-five protected structures listed in the Record of Protected Structures (RPS sites) in the study area boundary (Table 8-2 and shown in Figure 8-15) in the Graiguenamanagh Local Area Plan (2009-2020) and the Carlow County Development Plan. Of these only seven properties are located outside of the ACA of the town in the rural hinterland (Brandondale, C150; Creamery D150 and former school C148 in Graiguenamanagh (references on map: 30, 31, and 18) and the structures in Tinnahinch (CW498, CW497, CW501 and CW500 (references on map: 03,04,02, and 05).

Table 8-2 Protected Structures within the study area

Map No.	RPS Ref	NIAH Reg No:	Name/ Street	Location	Description
01	CW496 and C125	10302404 and 12318004	Graiguenamanagh Bridge	Graiguenamanagh and Tinnahinch	Seven-arch shale-built hump-back road bridge over river, c. 1765. A section of the bridge was blown up on 13 June 1798 by Crown Forces during the 1798 Rebellion to prevent the insurgents crossing into Co. Kilkenny. One of a number of bridges in Co. Kilkenny rebuilt following the "Great Flood" of 1763 and has associations with the 1798 Rebellion.
02	CW501	10302405	Tinnahinch Estate Cottage	Tinnahinch, Co. Carlow	Detached three-bay two-storey granite ashlar Tudor Revival estate cottage, c. 1835
03	CW498	10302406	Tinnahinch Lock No. 20, Barrow Navigation	Tinnahinch, Co. Carlow	Canal lock, c. 1790. Replacement gates, c. 1990. Detached lock keeper's house, c. 1790.
04	CW497	10302407	Canal Agents House, Barrow Navigation	Tinnahinch, Co. Carlow	Detached three-bay two-storey double-pile house built, c. 1850
05	CW500	10302403	Bennett's	Tinnahinch, Co Carlow	A small, three-bay, two-storey house of circa 1935 set in a terrace of earlier houses. The house is built of concrete blocks with lime pointing and a rudimentary shopfront with the name 'Bennett' in marbled lettering
06	D152	12318002	The Quay	Graiguenamanagh, Co. Kilkenny	Section of random rubble stone retaining wall which formed part of the quay, c.1900.
07	D153	N/a	Bridge (Footbridge)	Over Duiske River	Simple 5-span stone footbridge over Duiske River. (Clapper Bridge).
08	C149, D151	12318006	Waterside Guesthouse	Graiguenamanagh, Co. Kilkenny	Detached seven-bay four-storey part double-pile salt house, dated 1871, probably incorporating fabric of earlier building, pre-1840. Operated as a salt house throughout the nineteenth and early twentieth centuries.
09	C140	12318008	F.J. Murray, Lower Main Street	Graiguenamanagh, Co. Kilkenny	Terraced four-bay three-storey house, c.1800, possibly originally two separate two-bay three-storey houses with three-bay three-storey side (south) elevation. Renovated, c.1875, with pub front inserted to ground floor.
10	C141	12318009	O'Shea Russell	Graiguenamanagh, Co. Kilkenny	Terraced four-bay two-storey house, c.1825, with square-headed carriageway to left ground floor. Extensively renovated and timber shopfront added, c.1925

Map No.	RPS Ref	NIAH Reg No:	Name/ Street	Location	Description
11	C142	12318010	Valley Hardware	Graiguenamanagh, Co. Kilkenny	End-of-terrace three-bay three-storey house c.1900, possibly incorporating fabric of earlier house, pre-1840, on site with shopfront to ground floor.
12	C143	12318011	J. O'R.	Graiguenamanagh, Co. Kilkenny	Terraced four-bay three-storey house, c.1825, possibly originally two separate houses with square-headed carriageway to right ground floor. Renovated, c.1975, with shopfront inserted to left ground floor.
13	C144	12318012 &12318013	Barron's	Graiguenamanagh, Co. Kilkenny	Terraced two-bay three-storey house with dormer attic, c.1850. Renovated, c.1900 and in c.1950, with openings to ground floor remodelled to accommodate commercial use
14	C145	12318014	Barrack Video Library	Graiguenamanagh, Co. Kilkenny	Terraced four-bay three-storey house, c.1775, possibly originally Royal Irish Constabulary barracks. Reroofed, c.1950, possibly with dormer attic added.
15a 15b 15c	C124 C129 C128	12318015	Duiske Abbey Catholic Church	Graiguenamanagh, Co. Kilkenny	C124: Catholic abbey church of national importance originally forming the centrepiece of an extensive ecclesiastical complex founded by William The Elder Marshall (c.1146-1219), Earl of Pembroke, in 1204-12 for the Cistercian order. Dissolved, 1536. In ruins, pre-1774-post-1810. Reconstructed 1812, to accommodate use as church. Restored, 1974-80. C129: Graveyard to site with various cut-stone markers, pre-1536-present. C128: Gateway, built 1812
16	C146	12318016	Swap Shop	Graiguenamanagh, Co. Kilkenny	Terraced two-bay three-storey house, c.1850. Renovated, c.1900, with shopfront inserted to ground floor.
17	C147	N/a	Staunton House and shopfront	Main St. (E)	End of terrace, three-bay, three-storey house with stone shopfront with painted lettering and moulded plaster window architraves.
18	C148	12318018	Graiguenamanagh School (Abbey Hall)	Graiguenamanagh, Co. Kilkenny	Detached nine-bay double-height Classical-style school, c.1850. Extended, pre-1973. Used as library, pre-1977, and as a hall, post-1977. Freestanding monument, post-1921 to south-west. Gateway, c.1850, to south-west
19	C130	12318022	M. Ryan	Graiguenamanagh, Co. Kilkenny	End-of-terrace three-bay three-storey house, c.1900, on a corner site possibly incorporating fabric of earlier house, pre-1840, on site with pubfront to ground floor.
20	C131	12318023	Antiquarian Book Market (E. Prendergast)	Graiguenamanagh, Co. Kilkenny	End-of-terrace five-bay three-storey house, c.1875, possibly originally two separate two-bay three-storey (south) and three-bay three-storey (north) houses incorporating fabric of earlier houses, pre-1840, on site. Renovated, c.1900, with shopfront added to ground floor

Map No.	RPS Ref	NIAH Reg No:	Name/ Street	Location	Description
21	C132	12318024	M. Doyle	Graiguenamanagh, Co. Kilkenny	Terraced four-bay three-storey house, c.1875, possibly incorporating fabric of earlier house, pre-1840, on site with square-headed carriageway to left ground floor. Renovated, c.1900, with pubfront/shopfront added to ground floor.
22	C127	12318027 & 12318053	Chapel Street	Graiguenamanagh, Co. Kilkenny	End-of-terrace single-bay single-storey gable-fronted Tudor Revival-style c.1850. Now in private residential use. two of four identical units. The house is of notable as it was a mid-nineteenth century widow's house or almshouse sponsored by Lord Annaly of Callan, Dungarvan, Goresbridge, Gowran and Graiguenamanagh (the Gowran Castle estate).
23	C133	N/a	Main St Upper (W)	Graiguenamanagh, Co. Kilkenny	''The Globe'', three bay, three storey house with white lettering.
24	C134	12318039	Hughes	Graiguenamanagh, Co. Kilkenny	End-of-terrace five-bay three-storey house, c.1850, on a corner site possibly incorporating fabric of earlier house, pre-1840, on site. Renovated, c.1900, with shopfront inserted to ground floor. Now disused to ground floor.
25	C135	12318042	O'Connor's Parsons	Graiguenamanagh, Co. Kilkenny	Terraced two-bay three-storey house, c.1825, possibly originally forming part of larger five-bay three-storey composition with house to south (associated with Reg No: 12318042). Renovated, c.1900, with shopfront inserted to ground floor. Refenestrated, c.1975.
25a 25b	C135	12318043	Kissane	Graiguenamanagh, Co. Kilkenny	Terraced three-bay three-storey house, c.1825, possibly originally forming part of larger house to north. Refenestrated, c.1925. Renovated with shopfront inserted to left ground floor.
26	C136	N/a	'Street Scenes', House and Shop	Graiguenamanagh, Co. Kilkenny	End of terrace, single-bay, two-storey house with early timber shopfront to ground floor and two canted bay windows to side elevation.
27	C137	12318044	Graiguenamanagh Market House	Graiguenamanagh, Co. Kilkenny	Attached five-bay two-storey Classical-style market house with attic, c.1800, originally detached with three-bay two-storey pedimented breakfront. Extensively renovated, pre-1973, to accommodate commercial use. Extensively renovated, post-1973.
28	C138	12318045	Lower Main Street (off)	Graiguenamanagh, Co. Kilkenny	End-of-terrace two-bay two-storey over raised basement granite ashlar house, c.1825.
29	C139	12318046	Manning	Graiguenamanagh, Co. Kilkenny	End-of-terrace two-bay three-storey office building, c.1900, on a corner site with shopfront to ground floor, and single-bay three-storey side (south) elevation.

Map No.	RPS Ref	NIAH Reg No:	Name/ Street	Location	Description
					Attached two-bay two-storey gable-fronted residential house, c.1900, to west with two-bay two-storey linking range to right.
30	C150 C324	12318049	Brandondale House	Graiguenamanagh, Co. Kilkenny	Detached seven-bay single-storey country house within self-contained estate, extant 1815. Occupied, 1901; 1911. Sold, 1932. Renovated. Adjacent outbuildings, a walled garden, and a neo-medieval "hermitage" allegedly repurposing stone work reclaimed from Duiske Abbey. Estate has historic connections with the Burchaell family and a visit to Brandondale House inspired the short story "The Trout" by Seán Prionsias Ó Faoláin.
31	D150	12318050	Graiguenamanagh Creamery	Graiguenamanagh, Co. Kilkenny	Detached three-bay single-storey over raised base double-pile creamery with attic, post-1903. Extended, pre-1945. Now disused.
32	C126	N/a	Chapel St.	Graiguenamanagh, Co. Kilkenny	Four-bay, three-storey houses.
33	D160	12318047	Dry Dock	Right bank of the Barrow	Silted-up remains of former dry dock on right bank of Barrow, the sidewalls of which are still visible.

N/A = not applicable

Figure 8-15 Record of Protected Structures (RPS) at Graiguenamanagh and Tinnahinch
Key: RPS numbered, ACA outlined
(Source: Graiguenamanagh Local Area Plan 2009-2020 RPS Sites)

8.3.3.3 National Inventory of Architectural Heritage (NIAH)

The National Inventory of Architectural Heritage (NIAH) building surveys provide the basis for the recommendations of the Minister for Culture, Heritage and the Gaeltacht to the planning authorities for the inclusion of particular structures in their Record of Protected Structures. The published surveys are a source of information on the selected structures for relevant planning authorities. It is worthwhile noting that the NIAH survey is not considered to be a complete record of the architectural heritage of an area.

The properties recorded in the study area by the NIAH are considered as being buildings and structures of conspicuous historical, archaeological, artistic, scientific, social or technical interest and are recorded by this survey as having a 'Regional' rating. Structures that are considered of

regional significance are recommended by the Minister to the relevant planning authority for inclusion in their RPS and the planning authorities can add to the record at any time should the choose to adopt them.

The NIAH sites within the study area are indicated in Figure 8-16 and the NIAH sites not yet added to the RPS record is shown on Table 8-3. There are twenty-seven NIAH sites in the study area that have not yet been added to the RPS (Table 8-3).

Table 8-3: NIAH Sites within the study area that are not on the RPS list

Map No	NIAH Reg No:	Name/ Street	Location	Description
01	12318001	Bellevue House	Graiguenamanagh, Co. Kilkenny	Detached three-bay two-storey house, built c.1850. Renovated, c.1900 and c. 1950
02	12318003	Gateway	Graiguenamanagh, Co. Kilkenny	Road fronted gateway with cast iron and unpainted rendered piers, c.1900
03	12318005	Narrow Lane, The Quay	Graiguenamanagh, Co. Kilkenny	Attached three-bay two-storey house, c.1875, possibly incorporating fabric of earlier house, pre-1840. Part renovated, c.1975
04	12318007	F.J. F.J. Murray, The Quay	Graiguenamanagh, Co. Kilkenny	Terraced three-bay two-storey house, c.1775.
05	12318017	Corrigaleen (House)	Graiguenamanagh, Co. Kilkenny	Detached three-bay two-storey house, c.1875
06	12318019	Upper Main Street	Graiguenamanagh, Co. Kilkenny	Terraced two-bay two-storey house, c.1825, originally end-of-terrace. Renovated, c.1875, with shopfront inserted to right ground floor. Now disused.
07	12318020	O'Connell's	Graiguenamanagh, Co. Kilkenny	Terraced four-bay two-storey house, 1925, possibly incorporating fabric of earlier house, pre-1840, on site with shopfront to left ground floor.
08	12318021	Upper Main Street	Graiguenamanagh, Co. Kilkenny	Terraced two-bay three-storey house, c.1850, possibly incorporating fabric of earlier house, pre-1840, on site. Renovated, c.1950, with openings to ground floor remodelled to accommodate commercial use.
09	12318025	Graiguenamanagh	Graiguenamanagh, Co. Kilkenny	Detached four-bay two-storey house, c.1850. Renovated, c.1950. Extended, c.1975
10	12318026	Convent of the Sisters of Mercy (Gahan House)	Graiguenamanagh, Co. Kilkenny	Detached ten-bay two-storey convent, post-1903. Extended, c.1950. Now also in use as nursing home.

Map No	NIAH Reg No:	Name/ Street	Location	Description
11a 11b	12318028, 12318029	Graiguenamanagh Parochial House	Graiguenamanagh, Co. Kilkenny	Detached three-bay two-storey parochial house, post-1903. Detached four-bay single-storey outbuilding, post-1903.
12	12318030	Chapel Street	Graiguenamanagh, Co. Kilkenny	Detached five-bay two-storey house, c.1750, possibly over basement with single-bay two-storey side elevations. Refenestrated, c.1900. The house is of importance in the locality for the historic associations with Thomas Cloney (1774-1850), United Irishman.
13	12318031	Saint Peter's Church	Graiguenamanagh, Co. Kilkenny	Remains of detached three-bay double-height single-cell Board of First Fruits Church of Ireland church, dated 1809, with single-bay four-stage entrance tower to north-west on a square plan. In use, 1903. Now in ruins with nave mostly collapsed. Graveyard to side with cut-stone markers, post-1809-post-1903.
14	12318032	High Street	Graiguenamanagh, Co. Kilkenny	Single-arch rubble stone road bridge over river, c.1750. Sited spanning Duiske River.
15	12318033	Coffee On High	Graiguenamanagh, Co. Kilkenny	End-of-terrace three-bay two-storey house, c.1850. Renovated, c.1875, with shopfront inserted to ground floor. Reroofed, c.1950. Part refenestrated, c.1975.
16	12318034	Abbey Villa (House)	Graiguenamanagh, Co. Kilkenny	Terraced three-bay two-storey house, c.1875.
17	12318035	T. O'Shea	Graiguenamanagh, Co. Kilkenny	End-of-terrace two-bay three-storey house, c.1850, on a corner site possibly incorporating fabric of earlier house, pre-1840. Extensively renovated with replacement pubfront inserted to ground floor.
18	12318036	High Street	Graiguenamanagh, Co. Kilkenny	Attached five-bay four-storey warehouse, c.1850, originally detached with two-bay three-storey side elevations. Now disused and derelict. Associated with Reg 12318037.
19	12318037	High Street	Graiguenamanagh, Co. Kilkenny	End-of-terrace four-bay three-storey warehouse, c.1850, originally

Map No	NIAH Reg No:	Name/ Street	Location	Description
				attached on a slightly cranked plan with two-bay two-storey end bay to right having square-headed carriageway to ground floor. Extensively renovated, c.1975. Part reroofed. Now disused.
20	12318038	Cushendale Woollen Mills	Graiguenamanagh, Co. Kilkenny	Terraced eight-bay three-storey warehouse, c.1850, originally attached with square-headed carriageway to ground floor. Extensively renovated, c.1975. Now in use as woollen mill.
21	12318040	Angler's Rest (The)	Graiguenamanagh, Co. Kilkenny	Terraced two-bay three-storey house, c.1825. Extensively renovated, c.1900, with pubfront inserted to ground floor. Pubfront renovated.
22	12318041	Blanchfield	Graiguenamanagh, Co. Kilkenny	Terraced two-bay three-storey house, c.1825. Extensively renovated, c.1925, with shopfront inserted to ground floor. Shopfront renovated, c.1975.
23a 23b 23c	12318055, 12318054, 12318048	New Ross Road	Graiguenamanagh, Co. Kilkenny	Two end-of-terrace and one terraced three-bay two-storey estate worker's house, c.1825. Extensively renovated to accommodate use as apartments. Likely original associations with Brandondale House estate (Reg No 123181049)
24	12318057	New Ross Road	Graiguenamanagh, Co. Kilkenny	Detached three-bay two-storey house, post-1903.

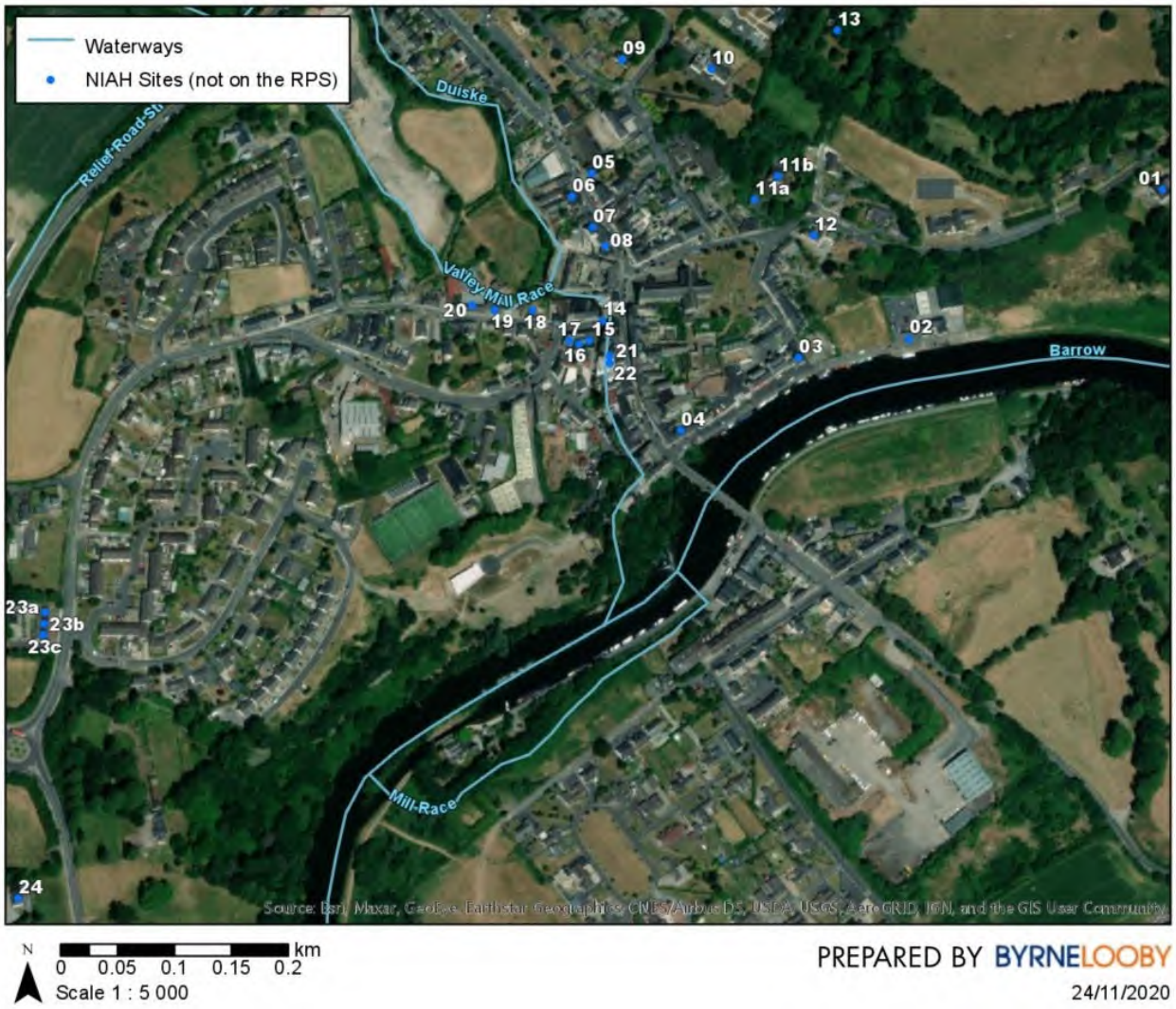


Figure 8-16: NIAH sites in the study area (not on the RPS)

8.4 Key Constraints

All archaeological and historic sites/features and properties with statutory designation in the study area are the key considerations in the constraints study in relation to cultural heritage, these sites have been identified and mapped for the constraints study. In summary the following constraints have been identified:

8.4.1 Archaeological Heritage

There is one national monument within the proposed development area, Duiske Abbey (RMP KK029-018001-, National Monument No 620). It is the physical and visual focal point of the town.

There are sixteen recorded archaeological monuments (RMP sites) within study area, all relating to the medieval heritage and industrial character of the area:

- Castle - tower house, Tinnahinch;

- Church Tinnahinch;
- Graveyard, Tinnahinch;
- Ritual site - holy well, Tinnahinch;
- Bridge Tinnahinch, Carlow Brandondale;
- Historic town, Graiguenamanagh;
- Religious house - Cistercian monks, Graiguenamanagh;
- Cross - High cross (present location), Graiguenamanagh;
- Tomb – effigial, Graiguenamanagh;
- Wall monument, Graiguenamanagh;
- Cross, Graiguenamanagh;
- Burial, Graiguenamanagh;
- Ritual site, holy well Graiguenamanagh;
- Clapper bridge, Graiguenamanagh;
- Water mill – unclassified, Graiguenamanagh;
- Cross - High cross, Graiguenamanagh, Kilkenny.

There is a designated Zone of Archaeological Potential (ZAP) in the Record of Monuments and Places around the historic town of Graiguenamanagh (KK029-018). Any development within this zone is considered to be of archaeological potential and is likely to reveal medieval or later archaeological remains, features finds or soils.

8.4.2 Architectural Heritage

Graiguenamanagh town is an ACA. The boundary encompasses the medieval core of the town, it incorporates the Turf Market, the bridge and the historic quay.

There are thirty-five RPS sites within the constraints study area, of these seven are outside of the ACA. These structures/features should be considered as cultural heritage constraints during the design of the proposed flood relief scheme and avoided where possible.

There are twenty-seven NIAH sites in the study area that have not been added to the RPS, however there is a potential that they may be added in the future.

Every care should be taken in these locations to avoid direct impacts on protected structures or by means of careful design or by the application of appropriate mitigation measures. This includes development that might adversely affect the setting of the protected structure. Any

design proposals in the vicinity of protected structures vicinity should be carried out in a way that will not materially affect the character, integrity, amenity and setting of these sites. An architectural conservation specialist may be required advise on appropriate measures mitigate any potential impact on this.

8.4.3 Archaeological/ Cultural Heritage Potential

There is the strong possibility that previously unknown archaeological deposits or features associated with the medieval and later milling in the area or with earlier river crossings may survive subsurface within the study area. For example, there a significant possibility that evidence of the medieval bridge wooden bridge at Brandondale (KK029-042-) may be unearthed during works along the Barrow on both sides of the river bank. Historic accounts of oak piles being recovered at the site during the construction of the Tinnahinch Lock further affirm this risk.

There is a general riverine archaeological potential along the Douske River and the River Barrow to reveal milling activity that could date from the 12th to the post medieval period.

There is a significant amount of industrial heritage features recorded in the RMP and RPS in the study area which is associated with a legacy of milling and transport. However, there are several sites and features that have yet to be recorded or identified. The industrial heritage potential is high some unrecorded features include.

- A mill race Running parallel to the Duiske river which that connected several recorded mills, any development in the vicinity of this has the potential to reveal further milling activity. The proposed storage areas are located in the vicinity of the mill race.
- There is also a mill race in Tinnahinch running parallel to the river Barrow and Canal tow path.
- There are several former mill/ industrial structures that are not protected these include structures in the Turf Market area and along the mill race and Duiske River.
- The canal and its associated protected lock and lock keepers house is considered to be of cultural heritage value and are part of the curtilage of the protected structures.
- There are several heritage trails within the town that must be maintained/ enhanced.
- Field work will identify unrecorded industrial heritage and cultural heritage features that might be impacted by the scheme.

8.4.4 Historic Character and Setting

Duiske Abbey commands a focal point at the centre of Graiguenamanagh. The narrow and winding medieval streets of the town centre, their interconnection with the Abbey, and the relationship with the River Barrow, and the Duiske River gives Graiguenamanagh its unique visual and aesthetic character.

The River Barrow, with its historic quays, mill buildings, mill races, bridges, canal, canal lock and weirs is a rich and highly significant cultural, historical industrial and social amenity of Graiguenamanagh- Tinnahinch. It is also a defining character, its visual relationship to the town and the Abbey should be retained. Every effort should be made to retain or enhance this amenity.

While change within the setting of an historic site or landscape may be acceptable, in certain instances development will be considered intrusive and inappropriate (such as large embankments, walls or similar permanent infrastructure). This effect on the setting of archaeological and architectural heritage sites requires an assessment to be made on a case by case basis according to the type of development, its location and landscape setting by means of objective analysis based on a set of predefined criteria and professional judgement, supported by appropriate descriptive material.

Specific mitigation requirements can only be identified as issues for development once the design options are defined. Further assessments such as archaeological testing, underwater archaeological assessments, structural architectural heritage appraisals or structural surveys etc. may be required in the next phases of the assessment or as mitigation measures for the scheme.

It should be noted, however, if flood relief measures impact any areas in proximity to an RMP, or in the ZAP of the town, the judicious use of archaeological assessment techniques may be required in these areas in order to understand the implications for the proposed scheme.

In accordance with the Architectural Heritage Guidelines any work to or in the vicinity of a Protected Structure, NIAH site or the ACA require a conservation heritage impact assessment by a conservation architect.

All recommendations made in this report are subject to approval of the relevant Local Authorities and the National Monuments Service, Department of Culture, Heritage and the Gaeltacht.

9 Landscape and Visual

9.1 Introduction

This section of the report provides a review of the landscape and visual constraints that have been identified within the study area.

For the purposes of this report, the study is defined as the area outlined in Figure 9-1. The landscape and visual constraints study area/ Zone of Theoretical Influence has been established based on the local topography, locations of sensitive receptors and views. The inner line (scheme area) represents the most sensitive zone and the outer line captures potential long range views/receptors.

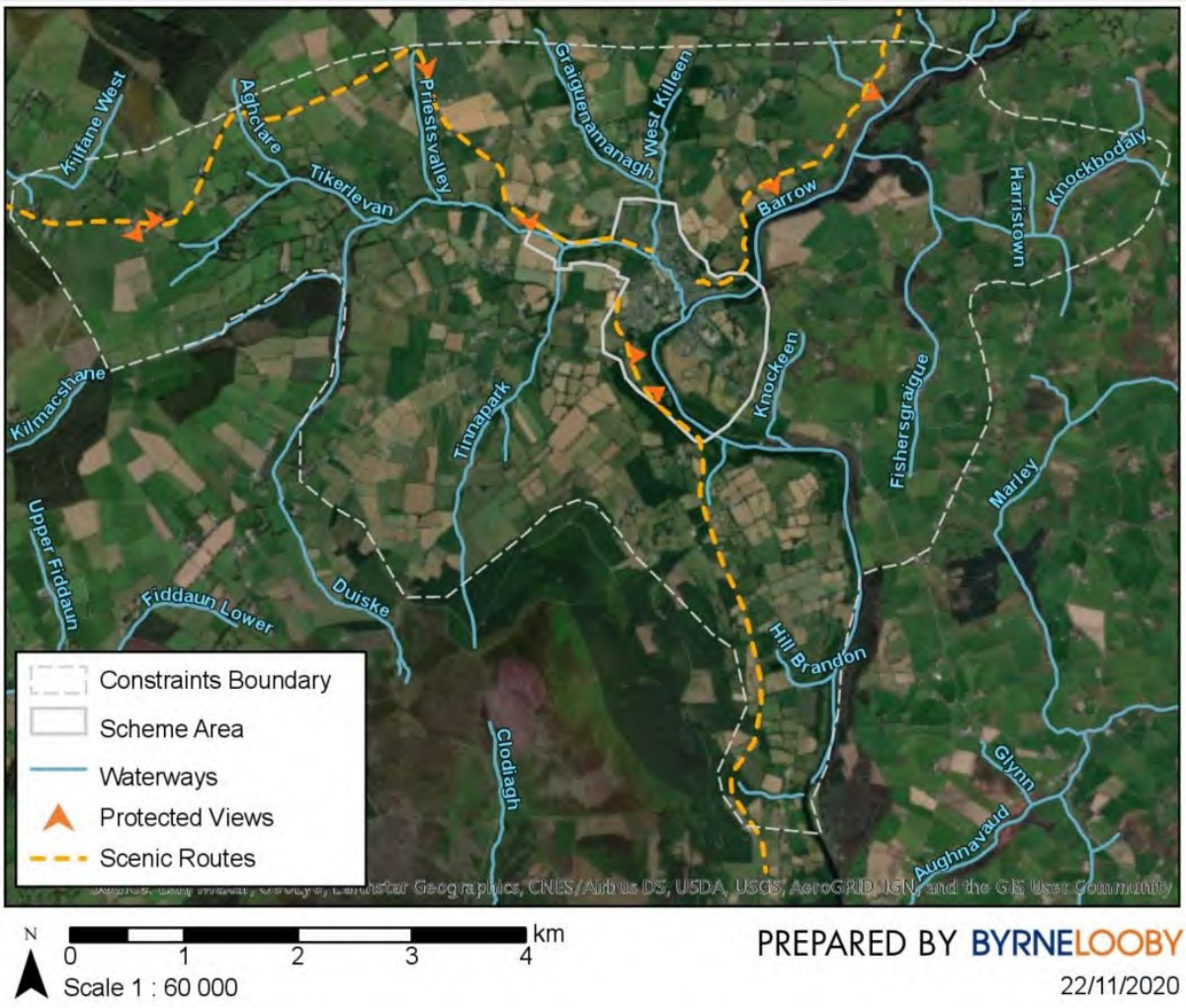


Figure 9-1 Landscape and visual constraints boundary, protected views and scenic routes

The study area encompasses the settlement of Graiguenamanagh-Tinnahinch located along the River Barrow, with Graiguenamanagh, west of the river, located within Co. Kilkenny and Tinnahinch, east of the river, located in Co. Carlow. The study area stretches to the south towards Brandon Hill and west along the Duiske River and the R703 towards Thomastown.

9.2 Methodology

The procedure used for the landscape and visual constraints study entailed a desktop study of the scheme area in relation to its overall context both locally and regionally and including a review of the relevant planning polices and publications, including the following:

- Kilkenny County Development Plan (KCDP) 2014 -2020
- Graiguenamanagh Local Area Plan (GLAP) 2009
- Landscape Appraisal of County Kilkenny 2003
- Carlow County Development Plan 2015 – 2021
- Tinnahinch LAP 2010-2016
- National Parks & Wildlife Service – location of SPAs, SACs and NHAs
- Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports (EPA, July 2017)
- Guidelines for Landscape and Visual Impact Assessment (Landscape Institute & I.E.M.A., UK 2013)
- National Landscape Strategy for Ireland 2015-2025

A site visit will be undertaken to assess the quality and type of views of the area, and the character and quality of the site area and the surrounding landscape when further details about the scheme become available.

9.3 Baseline / Receiving Environment

9.3.1 Landscape Character

The landscape setting of Graiguenamanagh–Tinnahinch is strongly influenced by its location within a narrow river valley and the upland areas that surround it. The settlement is located at a bend along the River Barrow and the relatively steep slopes of the river valley are a significant feature within the study area. The wider setting of the study area is of an undulating landscape due to Brandon Hill to the south, the upland areas at Glencoum to the north and the Blackstairs Mountains to the east.

9.3.1.1 Landscape Character Assessment (LCA)

Landscape character assessment is a process which describes, maps and classifies landscapes objectively. Defining landscape character enables an understanding to be formed of the inherent value and importance of individual landscape elements and the processes that may alter landscape character in the future. In relation to landscape character the Kilkenny County Development Plan 2014-2020 contains the following objective:

"Objective 8G: To protect and sustainably manage the landscape character of County Kilkenny, having regard to the findings of the landscape character assessment and the development management standards as set out in this chapter for the sustainable development of the county and appropriate conservation of its landscape character."

The Landscape Appraisal of County Kilkenny (2003) identifies Graiguenamanagh as falling within two Landscape Character Areas – Brandon Hill Uplands and the Barrow Valley.

"Brandon Hill Uplands – Landscape Character Area:

"This character area is a large upland area to the east of the County, whose principal upland areas include the Brandon and Croghan Hills to the east of the County. The hills are in an almost circular shape around the town of Graiguenamanagh. The terrain in this upland area slopes from the River Barrow valley at the east and the River Nore at the west. The primary and secondary ridgelines of the Croghan Hills vary in elevation from 263 to 365m above sea level, and the Brandon Hill primary ridgeline has an elevation of 515m above sea level. The elevated nature of this physical unit provides a defined skyline and significant and scenic views over the scenic River Barrow and Nore valleys and the towns of Inistioge and Graiguenamanagh. These uplands also form part of the South Leinster Way walking route. Distant views also include those of the Blackstairs Mountains. The area is perceived as highly scenic and of significant visual amenity value within the County, and a number of scenic drives are identified. Brandon Hill and its environs are perceived as sensitive landscapes, with low and limited development potential, with only tourism development being considered acceptable.

"Critical Landscape Factors:

- Elevated Vistas
- Steep Slopes
- Prominent Ridge Lines
- Undulating topography
- Low Vegetation
- Shelter Vegetation

"The Barrow Valley – Landscape Character Area:

"The Barrow Valley is an extensive river valley flowing in a north-south pattern to the east of the County. Many local villages have become well established along the riverbanks, such as Graiguenamanagh and Goresbridge. The river valley is identifiable by its floodplain levels and slopes of deciduous trees with a slow progression to pasture lands. Running along the Barrow Drive, the riverbanks are predominately grassland. Large tillage fields with few inner boundaries are particular to this area. Estate landholdings are bounded by stonewalls and gateposts with large parcels of grazing lands within. The terrain is undulating with extensive views of mountains (Castlecomer, Freagh and Brandon Hills and South Leinster Way) and coniferous plantations

(along Brandon Tow Path). Distant views also include the Blackstairs Mountains in Co. Carlow. The area is perceived as highly scenic as well as special and sensitive in landscape terms, providing significant visual amenity value to the County. Consequently, it is considered to have tourism potential, particularly around Graiguenamanagh.

"Critical Landscape Factors:

- Smooth Terrain
- Low Vegetation
- Localised River Views
- Undulating topography
- Shelter Vegetation"

Based off the Landscape Character Appraisal (2003), the Kilkenny County Development Plan 2014-2020 refers to 'Landscape Areas of Highly Scenic and Significant Visual Amenity Value' in particular Brandon Hill Uplands and the River Valley Areas of the Rivers Nore, Barrow and Suir have been identified as being highly scenic and visually pleasing, and as having significant visual amenity value and tourism potential.

The landscape character areas, landscape sensitivities and protected views for Co. Kilkenny are shown in Figure 9-2, Figure 9-3, and Figure 9-4. The landscape character areas and types for Co. Carlow are shown in Figure 9-5 and Figure 9-6.

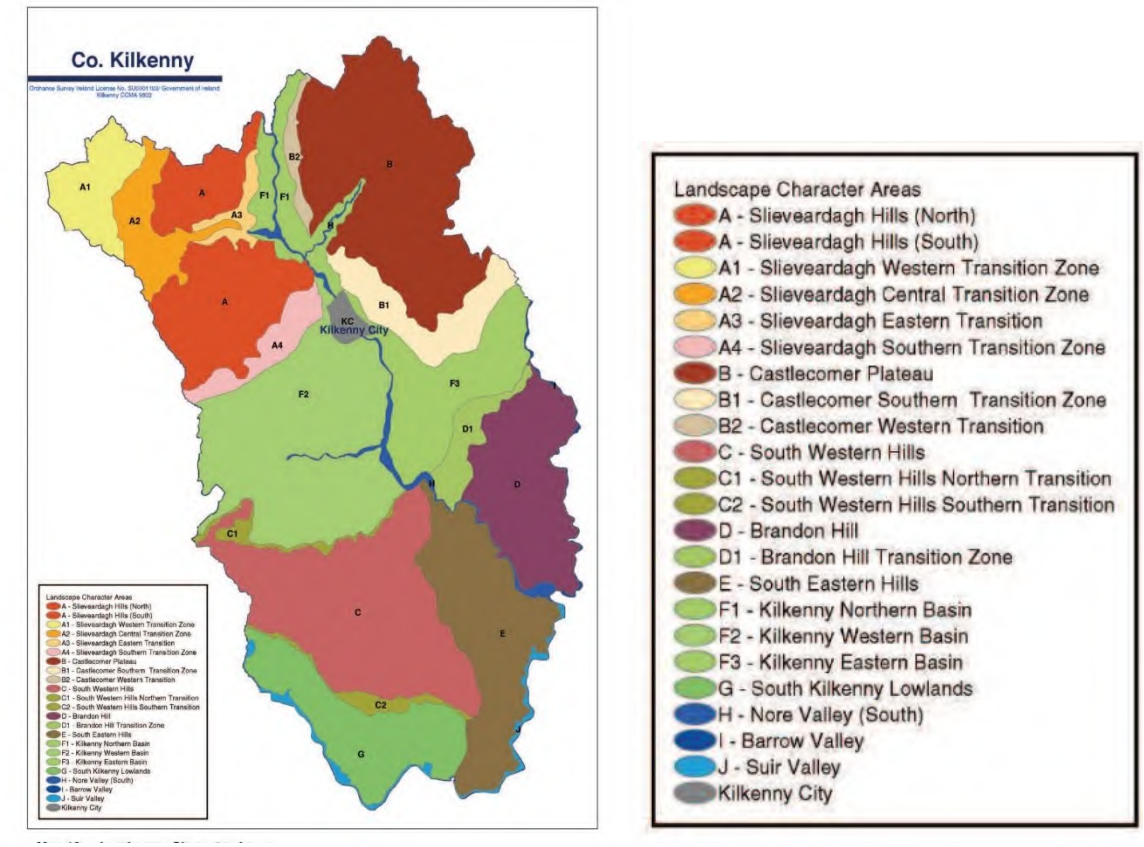


Figure 9-2 Landscape Character Areas (Co. Kilkenny)
Source: Landscape Appraisal of County Kilkenny (2003)
Character Areas Co. Kilkenny. Source: Landscape Appraisal of County Kilkenny (2003)

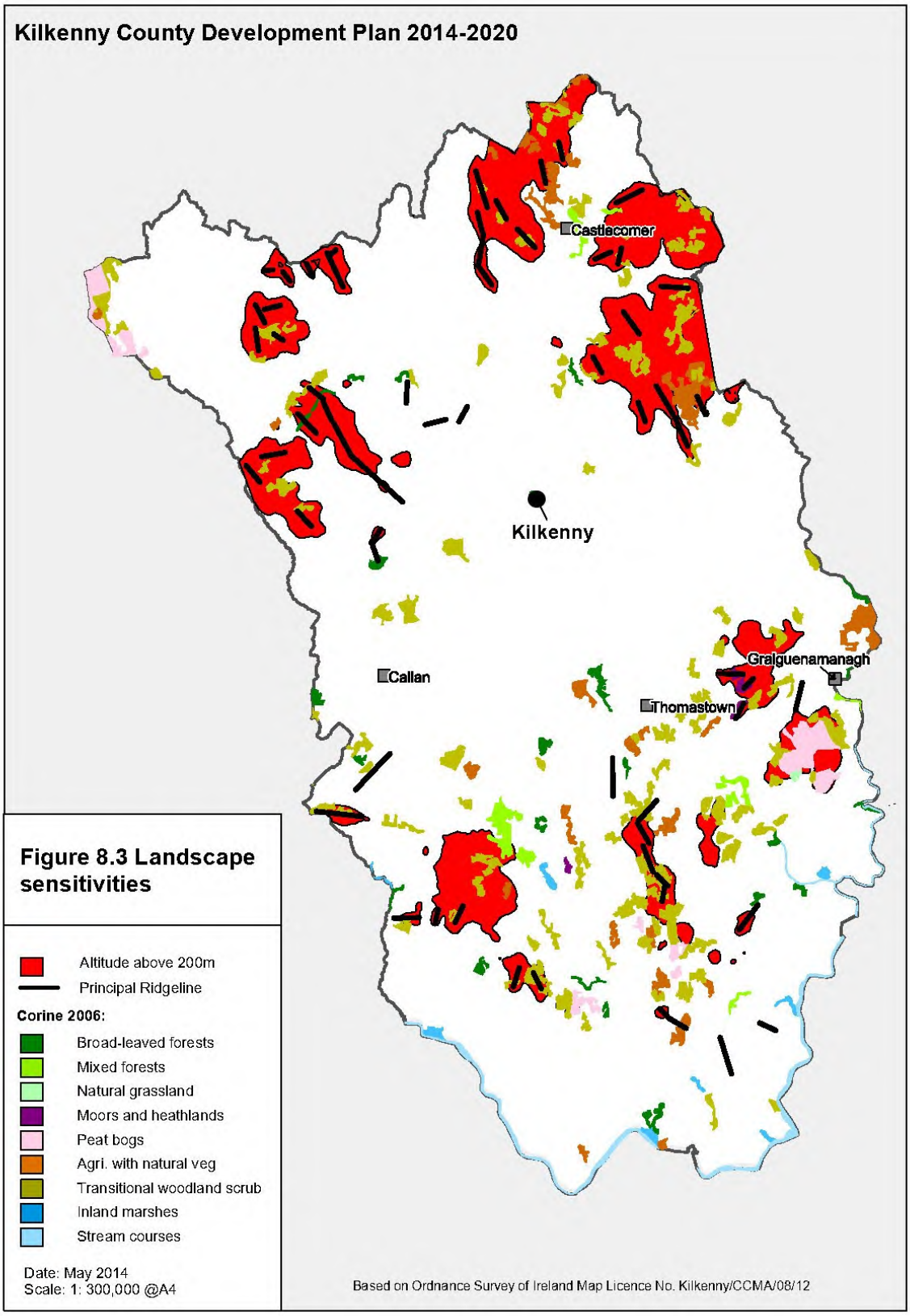


Figure 9-3 Landscape Sensitivities (Co. Kilkenny)
Source: Kilkenny CDP 2014-2020

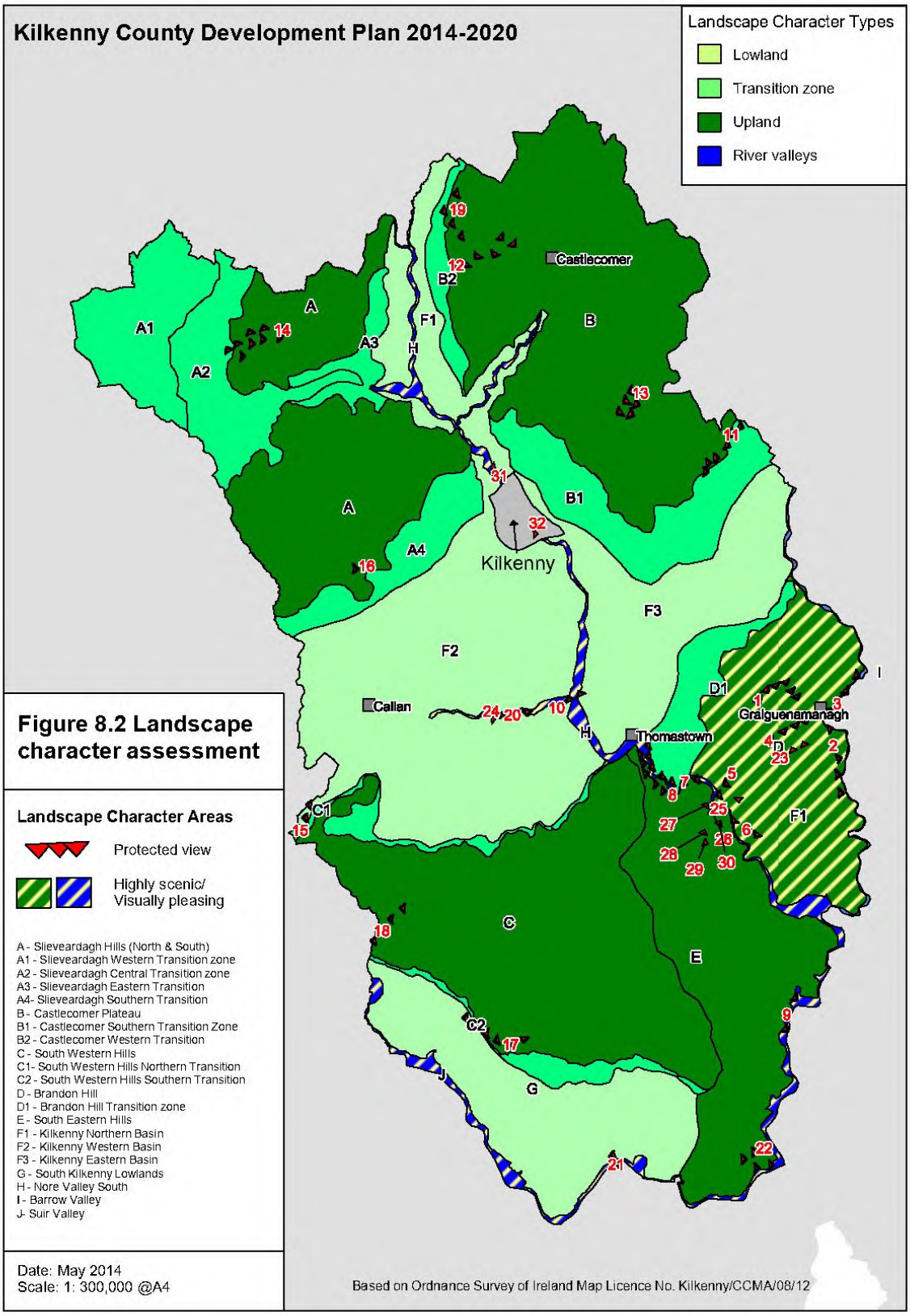


Figure 9-4 : Landscape Sensitivities, Character Areas & Protected Views (Co. Kilkenny)
Source: Kilkenny CDP 2014-2020

Figure 9-5: Landscape Character Areas (Co. Carlow)
Source: Carlow County Development Plan 2015

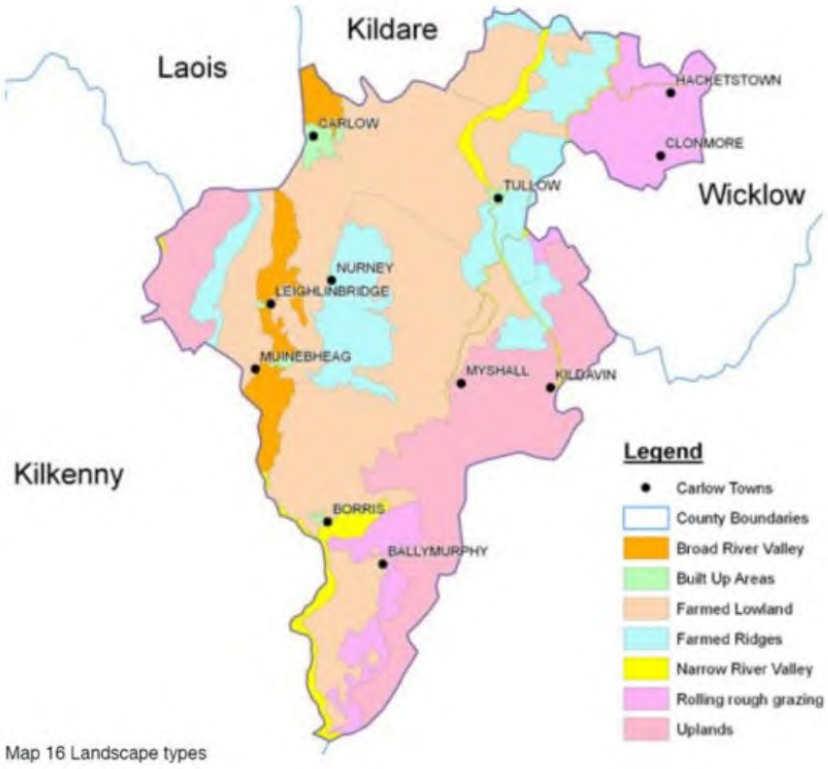


Figure 9-6: Landscape Character Types (Co. Carlow)
Source: Carlow County Development Plan 2015 – 2021

9.3.1.2 Landscape Character Sensitivity

The sensitivity of the Landscape Character Areas is defined as its overall resilience to sustain its character in the face of change and its ability to recover from loss or damage to its components.

Landscape Appraisal of County Kilkenny (2003) which states that both the Upland LCA and the River Valleys LCA are visually vulnerable, they may contain areas of 'internal' visual robustness (see also Figure 9-3).

The Carlow County Development Plan 2015–2021, identifies Tinnahinch as being within 'Narrow River Valley' Landscape Type which is classified as Level 5 –the landscape type that is most sensitive to change.

9.3.2 Historic Landscape Characterisation (HLC)

No historic landscape characterisation has been undertaken for the vicinity of the scheme boundary at the time of writing.

9.3.3 Existing Trees and Hedgerows

There are areas of mature woodland, tree planting and hedgerows within and around the study area.

While there are no Tree Preservation Orders within the study area, the woodland, tree planting and hedgerows provide significant visual and residential amenity and biodiversity benefits within this area and the surrounding environment.

The Kilkenny CDP (2014 -2020) states that woodlands, trees and hedgerows "contribute significantly to the biodiversity and landscape character of the county and form part of a network of habitats, ecological 'corridors' and 'stepping stones' essential for wildlife to flourish and move between and within habitats. They are also an important part of our townscapes."

Kilkenny CDP 2014 -2020 - Woodlands, Trees and Hedgerows Objective 8F: "Kilkenny County Council will promote the planting of native tree and shrub species, by committing to using native species (of local provenance wherever possible) in its landscaping work and on County Council property."

The 'Survey of Woodlands in County Kilkenny' (Harris, 1996) identifies the following woodlands in the vicinity of Graiguenamanagh:

- Ballynakill woodland (Co. Kilkenny Woodlands Survey Site Code 011):
    - extensive woodland south of Graiguenamanagh covers approximately 16 ha. to the west of the New Ross road;
    - woodland is visually prominent from Graiguenamanagh and along the Barrow valley;
    - important visual landmark when approaching the town from New Ross;

- the mature deciduous wood has good ecological potential and little disturbance due to wet, steep conditions;
- pedestrian access is limited to the uphill side of the wood via the South Leinster Way;
- considerable recreational potential in the wood due to its scenic location adjoining the main road and its proximity to the town centre (c. 1 km).

- Ballynakill Wells wood (Co. Kilkenny Woodlands Survey Site Code 012):
  - coniferous plantation, south west of Ballynakill woodland.
- Graiguenamanagh wood (Co. Kilkenny Woodlands Survey Site Code 073):
  - approximately 7 ha., located to the north of Graiguenamanagh along the western bank of the River Barrow;
  - likely associated with Bellevue House;
  - dense and varied canopy and relatively open under-storey;
  - the wood is located on the South Leinster Way and there is good pedestrian access from Graiguenamanagh along a surfaced footpath;
  - access within the woodland itself is limited due to steep terrain and lack of defined path system;
  - the woodland has good amenity potential due to its proximity to the town centre (approx. 1km) and its position between the road and the river.

The Graiguenamanagh Local Area Plan 2009 identifies trees and hedgerows of visual importance (refer to Figure 9-7) and states that:

"In addition to sites which are subject to legal protection under National or EU law, and to the identified woodlands of the 'Survey of Woodland in County Kilkenny', there are landscape features that are important in contributing to the biodiversity, landscape value and sense of place of Graiguenamanagh. These features include hedgerows, ditches and banks, stone walls, small woodlands, streams and associated riparian zones."

9.3.4 Land Use Zoning

There are a variety of land uses zoned within this study area as shown on Figure 3-5 and Figure 9-7.

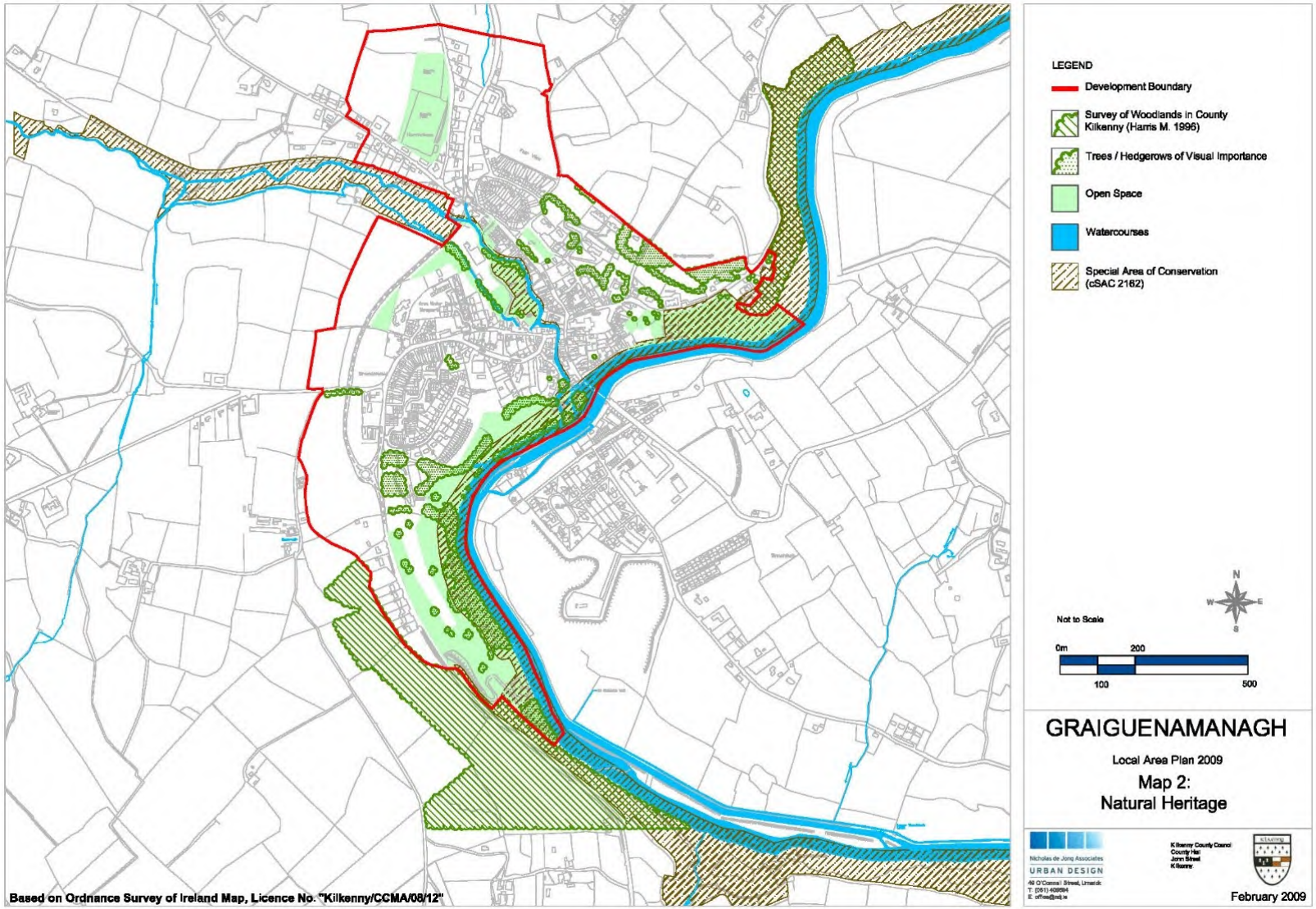


Figure 9-7 Survey of Woodlands in Co. Kilkenny and Trees and hedgerows of visual importance.
(Source: Graiguenamanagh LAP 2009)

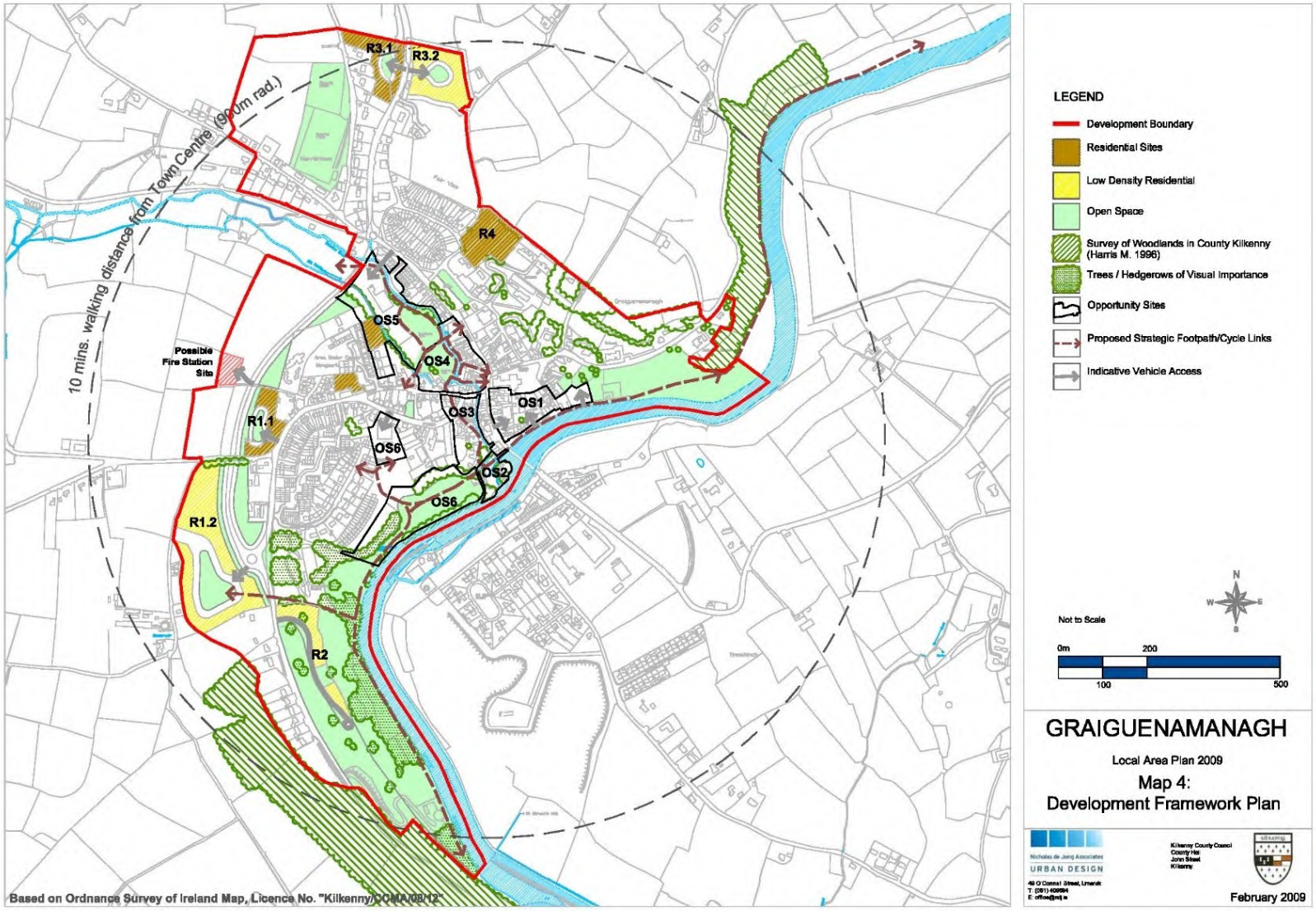


Figure 9-8 Graiguenamanagh Development Framework Plan
(Source: Graiguenamanagh LAP 2009-2015)

The town is located at the junction of two significant 'Waymarked Ways' (Figure 9-9):

- The South Leinster Way – which extends 102km from Kildavin in County Carlow to Carrick in Suir in County Tipperary via Tinnahinch and Graiguenamanagh.
- The Barrow Way – which is a 113km walk from Lowtown in County Kildare to St. Mullins in County Carlow.

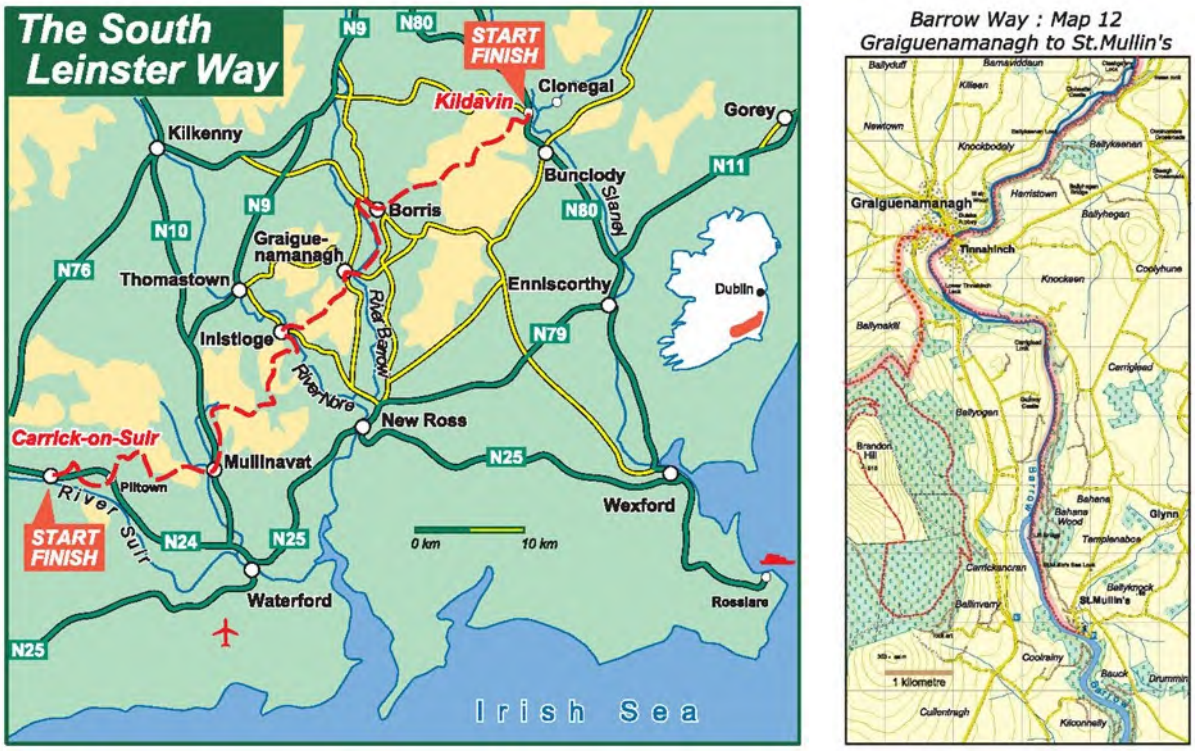


Figure 9-9 Walking Trails - The South Leinster Way & The Barrow Way
(Source: www.sportsireland.ie)

In relation to landscape and green infrastructure the Kilkenny County Development Plan 2014 - 2020 contains the following objectives:

Objective 8D: To prepare and support the implementation of a Green Infrastructure Strategy for County Kilkenny, as resources allow.

Objective 8E: To protect and where possible enhance wildlife habitats and landscape features which act as ecological corridors/networks and stepping stones, such as river corridors, hedgerows and road verges, and to minimise the loss of habitats and features of the wider countryside (such as ponds, wetlands, trees) which are not within designated sites. Appropriate mitigation and/or compensation measures to conserve biodiversity, landscape character and green infrastructure networks will be required where habitats are at risk or lost as part of a development.

The Carlow County Development Plan 2015 – 2021 contains the following reference to the River Barrow and the national walking route:

"The Barrow Corridor is a significant natural asset to County Carlow with great potential for tourism and recreation, subject to a sustainable approach to all development. The Corridor provides particular opportunities for;

- Boating and cruising development
- Nature and Wildlife Sites of interests
- Cultural tourism
- Activities along tourism trails
- Enhancement of the Barrow Way and South Leinster Way Trail and walks along old railway lines such as the Borris Viaduct
- Fishing and Angling

Recreational – Objective 2

- All proposals for new cycling or walking routes should be assessed in accordance with appropriate environmental assessments including Habitats Directive Assessment."

9.3.5 Protected Views, Corridors and Prospects

The Kilkenny CDP 2014 -2020 states that:

"There is a need to protect and conserve views and prospects adjoining public roads and river valleys throughout the county where these views are of high amenity value. In conserving views, it is not proposed that this should give rise to the prohibition of development along these routes but development, where permitted, should not seriously hinder or obstruct these views and should be designed and located to minimise their impact."

Objective 8H: To preserve and improve places or areas from which views or prospects of special amenity value exist.

Views to be preserved and protected in the vicinity of Graiguenamanagh, as identified in the Kilkenny County Development Plan 2014 – 2020 and the Graiguenamanagh Local Area Plan 2009:

- V1 View east and south over the Barrow valley on the Thomastown / Graiguenamanagh Road, R703 from Coppenagh Hill between the junctions with road numbers LP 4203 and LT 82152.
- V2 View East over the Barrow Valley on the Graiguenamanagh / New Ross Road and in particular the views overlooking St. Mullins, between the junctions with road numbers LP 4209 and LT 82463.
- V3 View east over the Barrow Valley on the Graiguenamanagh / Ullard Road just North of Graiguenamanagh, Road No. LS 8221 between the junctions with road numbers 438 and LS 8222.

The Carlow County Development Plan 2015 – 2021 identifies a number of views, prospects and scenic routes (refer to Figure 9-10), those while not within the study area but are in close proximity are listed in Table 9-1 below.

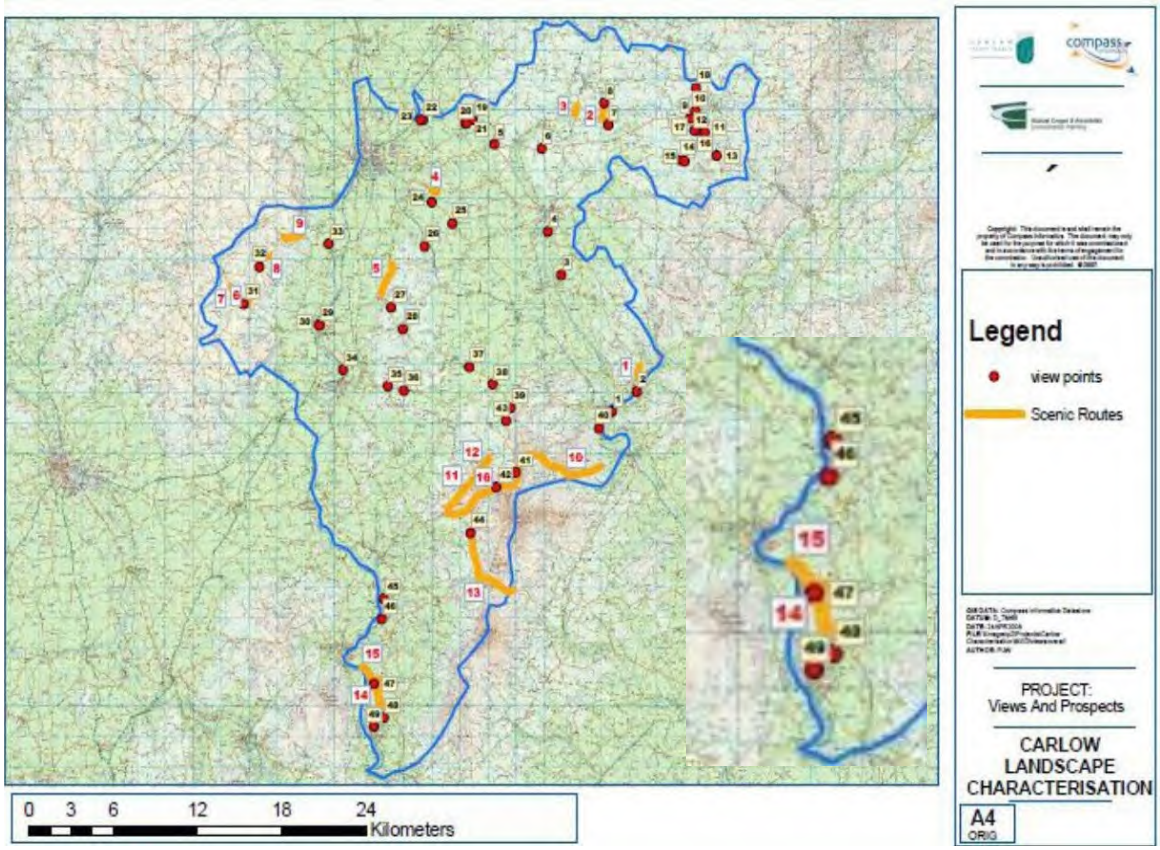
Table 9-1: Views and Scenic Routes in close proximity to study area

View Nr	Location	Orientation	Route	Type	Features
45	Cournellan	East	R729	Vista	Panoramic view of Blackstairs
46	Clashganny Locks		R729	View	River Barrow. Marked viewing point
47	Carriglead	East	L3008	Vista	South end of Blackstairs
Scenic Route Nr	**Location**		**Route**		**Features**
14	Carriglead/Glynn		L7061		Blackstairs
15	South from Graiguenamanagh		L3008		Barrow Valley and Kilkenny hills to west

(Source: Carlow County Development Plan 2015 – 2021)

9.3.6 Protected Structures, Recorded Monuments, NIAH and Statutory Designations

A description for archaeological, architecture and cultural heritage in the scheme area is provided in section 8.3. Special Areas of Conservation, Special Protection Areas, and Natural Heritage Areas are described in section 7.



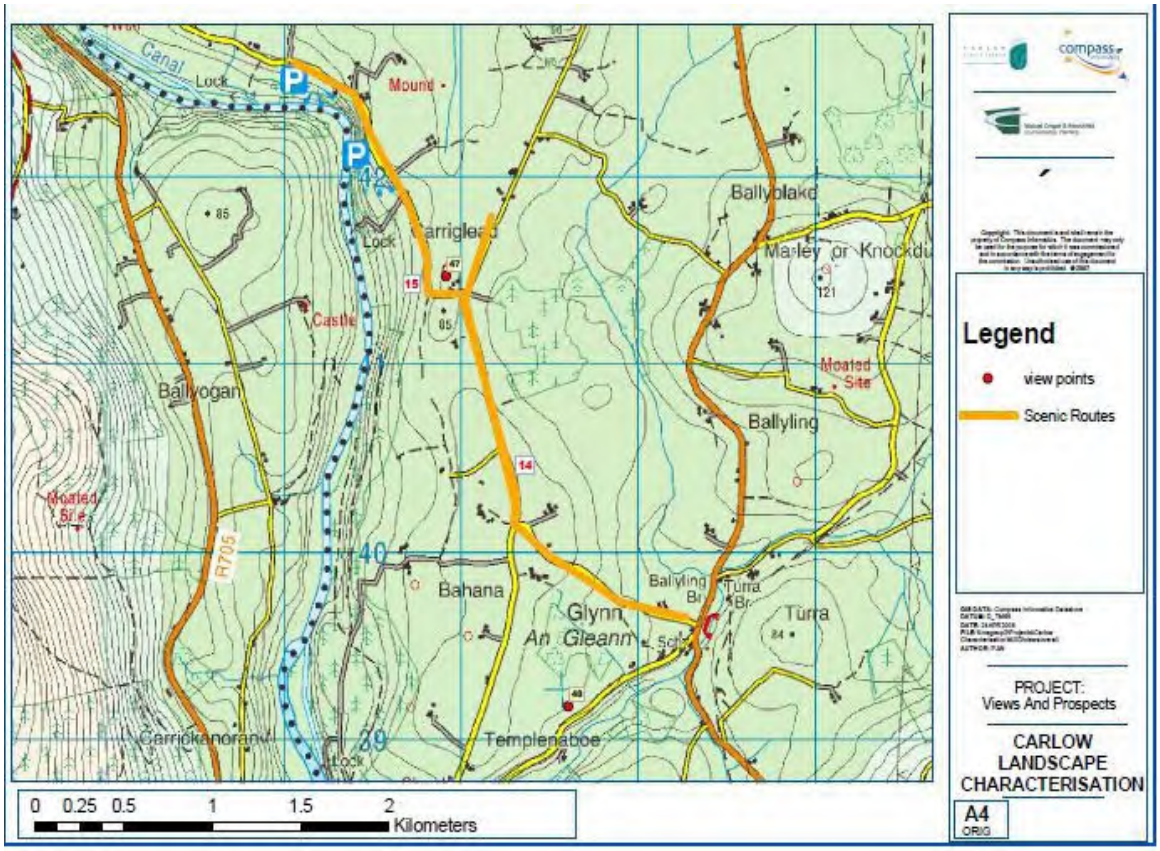


Figure 9-10 Protected Views & Scenic Routes with zoom in of Tinnahinch and surrounding area (Source: Carlow County Development Plan 2015 – 2021)

9.4 Key Constraints

9.4.1 Existing Trees and Hedgerows

The study area contains outdoor amenity areas, matures stand of trees and small woodlands and tree lined recreational pathways along both sides of the River Barrow and sections of the River Duiske. The retention and protection of trees and woodlands within Graiguenamanagh - Tinnahinch and surrounding areas in the valley is emphasised with the Kilkenny CDP (2014 - 2020). There are areas of woodland, trees and hedgerows also contained with the River Barrow and River Nore Special Area of Conservation (SAC Site Code: 002162). The existing trees and planting within the study area provides both visual and recreational amenity for the residential and amenity areas within the study area and the wider districts. Additionally, the 'green' character of the landscape is considered by KCC and CCC to be a key component of local tourism development for Graiguenamanagh-Tinnahinch and the wider area. Additionally, such areas also provide a network of habitats, ecological 'corridors' and 'stepping stones' essential for wildlife.

9.4.2 Landscape Character

The proposed development of the subject site will result in a change to the landscape character which will be most noticeable locally, such as from the adjacent residential and tourist areas (including along the river banks and bridges). It may also result in a change to the landscape character within the wider vicinity of the Barrow Valley. The potential magnitude of this change will be assessed when the details, scale and extent of the proposed interventions have been finalised.

9.4.3 Historical landscape character and cultural heritage

Within the study area there are several designations and structures of national interest that need to be considered such as:

- A number of Protected Structures and Recorded Monuments within or in close proximity of the study area (refer to section 8 of this report for more details).
- Conservation Area.
- Zone of Archaeological Interest.
- Sites of Archaeological Interest.

9.4.4 Recreational amenity value

There are several recreational amenities within the study area that need to be considered in relation to possible impacts on their accessibility, recreational and visual values:

- Walking/ cycling pathways along much of the length of the river, including national Waymarked Ways.

- An outdoor activities hub located in Graiguenamanagh on the bank of the River Barrow.
- Land use zoning objectives in county development plans – areas zoned as Amenity & Open Space/ Biodiversity.
- Swimming area and diving board area in the River Barrow.

9.4.5 Views & Visual Amenity Value

Key viewpoints will be selected when the details, scale and extent of the proposed interventions have been defined, these shall include views into and out of the study area and those that demonstrate the visual amenity value within the locality.

There is a need to protect:

- Residential views towards the rivers and Graiguenamanagh Bridge.
- Views towards the rivers and Graiguenamanagh Bridge from busines serving the tourism and recreational sector (e.g. cafes, etc).
- Recreational views – towards to and from the river (e.g. public pathways and parks).
- Views for entering the town from the surrounding areas in the valley by road (e.g. for drivers, cyclists, walkers, etc).
- Views from the national waymarked trails.

Views to be preserved and protected in the vicinity of Graiguenamanagh, as identified in the Kilkenny development Plan 2014 – 2020 and the Graiguenamanagh Local Area Plan 2009 are:

- V1 View east and south over the Barrow valley on the Thomastown / Graiguenamanagh Road, R703 from Coppenagh Hill between the junctions with road numbers LP 4203 and LT 82152.
- V2 View East over the Barrow Valley on the Graiguenamanagh / New Ross Road and in particular the views overlooking St. Mullins, between the junctions with road numbers LP 4209 and LT 82463.
- V3 View east over the Barrow Valley on the Graiguenamanagh / Ullard Road just North of Graiguenamanagh, Road No. LS 8221 between the junctions with road numbers 438 and LS 8222.

There is a need to protect and minimise any negative impact on the following views in particular:

- Protected views as identified in the KCDP 2014 – 2020 and the GLAP 2009.
    - particularly the protected views along the R703 which forms the boundary of the study area to the west.

- Public, recreational and residential views to and from the rivers and bridges, with emphasis on area that may be visually impacted by the suggested hard defence proposals in CFRAM:
    - Towards and from The River Barrow and River Nore Special Area of Conservation SAC (including the Duiske River)
    - Towards and from Recorded Monuments and Protected Structures e.g. bridge, Tinnahinch Castle
    - Public pathways, amenity areas and national 'Waymarked Ways' such as The South Leinster Way and The Barrow Way which pass through the study area.
    - Other tourist amenities e.g. guesthouses, cafes, restaurants, seating areas,

9.4.6 Construction Phase and Operational Phase

During the construction phase, the following elements of the proposed development have the potential to cause visual impacts, they will however be short to medium term in duration:

- Temporary site works – hoarding, lighting, cranes, car parking, storage areas
- Construction traffic – dust and emissions
- Tree and vegetation clearance
- Groundworks – cut and fill excavations
- Laying of foundations

The principal elements which are likely to give rise to landscape and visual impact visual impact in the long term/operational phase are:

- Removal of some existing trees
- Height of proposed structures/ interventions
- New structures/ interventions
- Change of character – dependent on proposed interventions type and scale
- Proposed tree and shrub planting

Appropriate design, siting and mitigation measures are required to integrate the proposed scheme within the landscape.

10 Air Quality

10.1 Introduction

This section describes the existing air quality and existing noise environment in the scheme study area and identifies possible issues which have the potential to constrain the flood relief scheme design.

For the purposes of this report, the study is defined as the area shown in Figure 10-1 which includes the towns of Graiguenamanagh (County Kilkenny) and Tinnahinch (County Carlow) and some of the surrounding rural area (up to an outer extent of 500m).

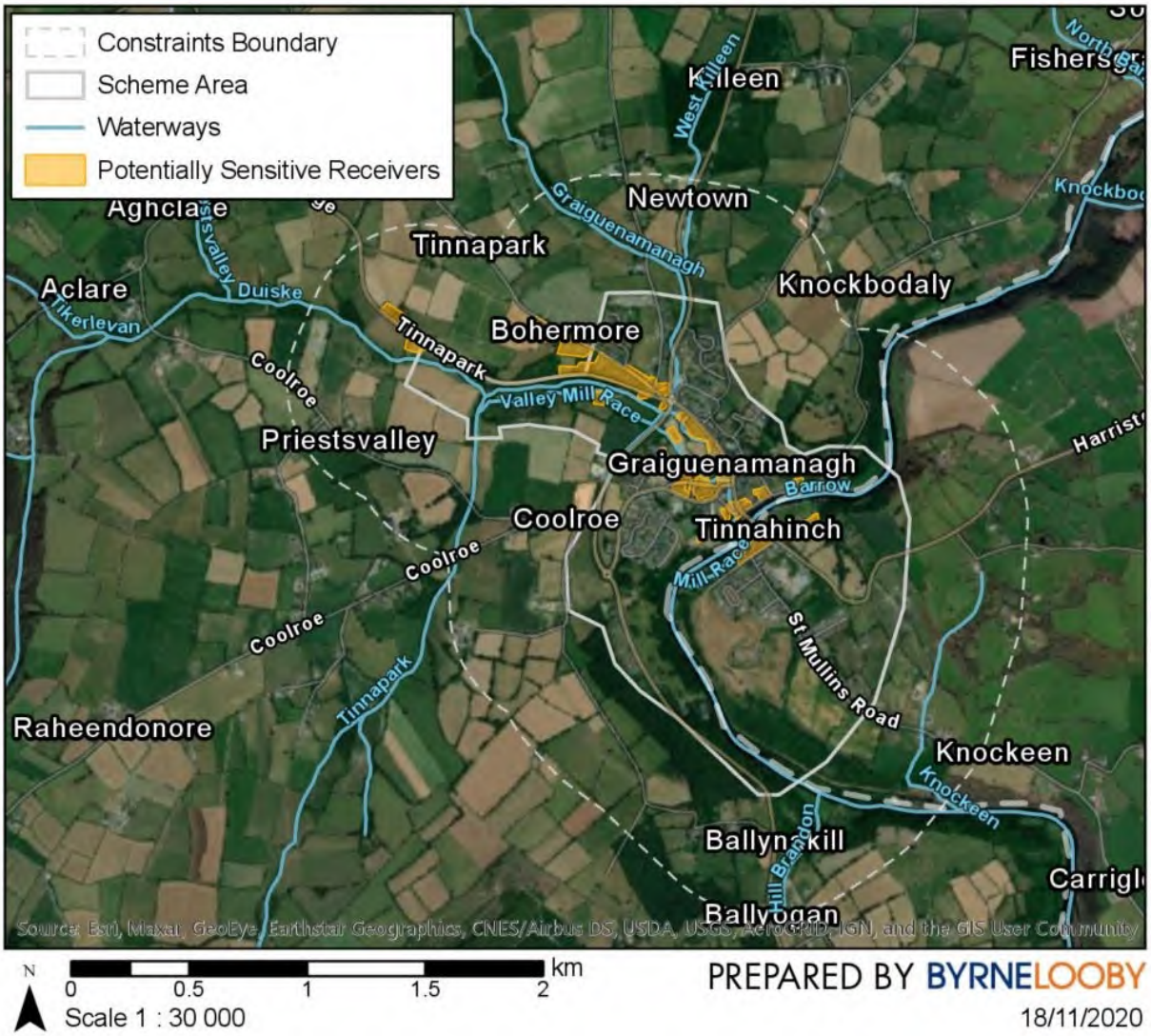


Figure 10-1 Constraints study area for air quality

10.2 Baseline / Receiving Environment

The scheme study area is comprised of rural areas, small villages and settlements, farmland, open spaces and the main towns of Graiguenamanagh and Tinnahinch.

Under the Clean Air for Europe Directive, EU member states must designate "Zones" for the purpose of managing air quality. For Ireland, four zones were defined in the Air Quality Standards Regulations (2011). The zones were amended on 1 January 2013 to take account of population counts from the 2011 CSO Census and to align with the coal restricted areas in the 2012 Regulations (S.I. No. 326 of 2012).

Ireland is divided into zones (Zones A, B C and D) for the assessment and management of air quality, in compliance with EU legislation. The scheme study area is located in Zone D: Rural Ireland ('Rural East'). According to the EPA Air quality index for health (AQIH) the air quality of the zone in which Graiguenamanagh-Tinnahinch is located was reported as '2 - Good' (data correct as of 4th November 2020) (source: EPA air quality zone data and Map viewer).

Sensitive receptors within the scheme study area with respect to air quality and climate are predominantly people. This includes homes, schools, medical centres, businesses, and places of worship. Flora and fauna can also be sensitive to air quality and climate. Biodiversity is dealt with in Section 7.

During the construction phase, sensitive receptors may be impacted due to construction activities and construction traffic. Climate change may also be considered as a constraint on the design of the scheme, as higher rainfall and extreme weather events attributing to climate changes may lead to higher water levels, which would influence the design of the scheme. Management measures will be implemented to control potential impacts.

The operational phase will not result in any impacts in relation to air and will have will be beneficial to the surrounding property owners in alleviating flooding which may increase in frequency due to climate change.

10.3 Key Constraints

The key constraints in relation to air quality and climate are any sensitive receptors in proximity to the location of construction works. The scheme design should take into consideration any air/climate sensitive receptors such as residences, schools, businesses, and medical facilities located in proximity to works associated with the flood relief scheme. The potential impacts of climate change will need to be considered in the design of the proposed scheme.

11 Noise and Vibration

11.1 Introduction

This section describes the existing noise environment in the scheme study area and identifies possible issues which have the potential to constrain the flood relief scheme design.

For the purposes of this report, the study is defined as the area shown in Figure 11-1 which includes the towns of Graiguenamanagh (County Kilkenny) and Tinnahinch (County Carlow) and some of the surrounding rural area (up to an outer extent of 500m).

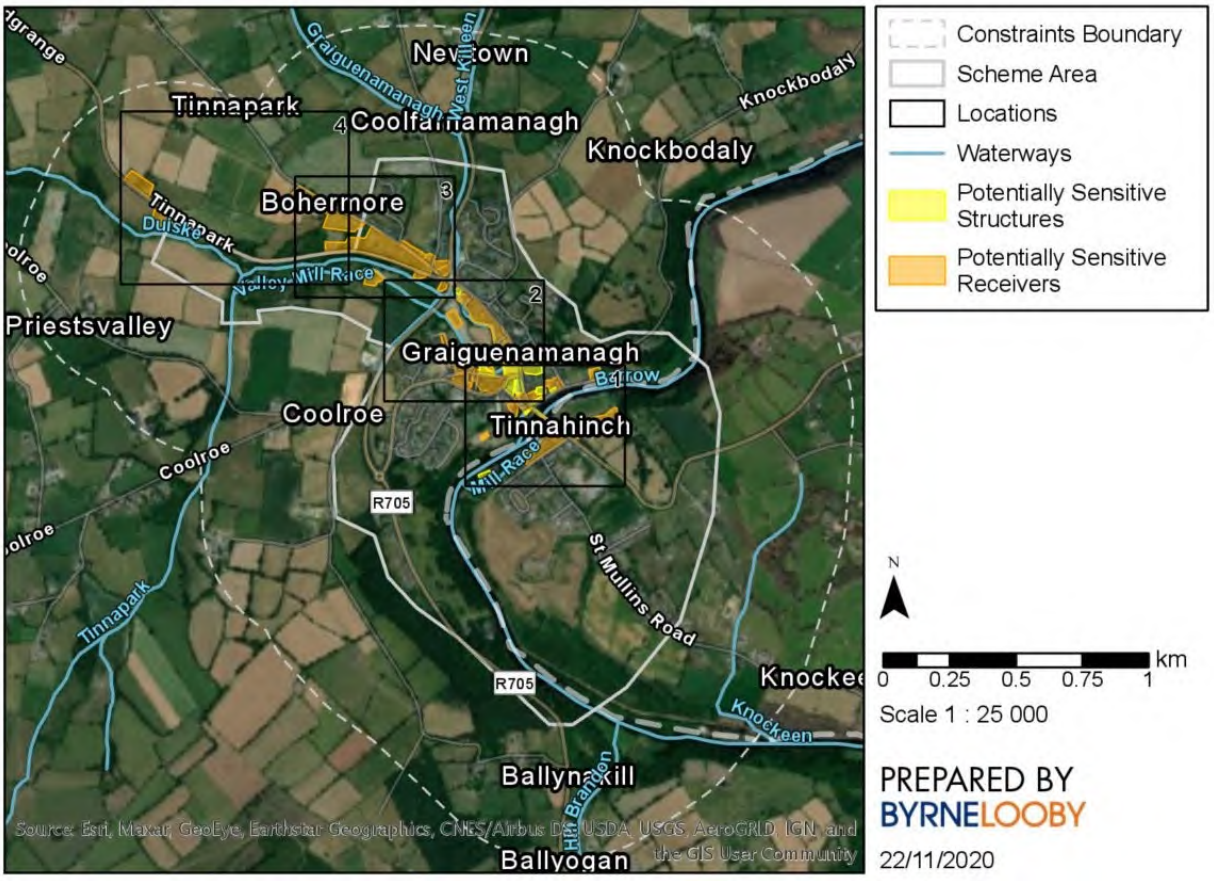


Figure 11-1 Constraints study area for noise and vibration

11.2 Methodology

A desktop review of the potential impact of noise and vibration associated with the proposed flood defence works in the Graiguenamanagh Tinnahinch area has been undertaken. The aims of this desktop review were to:

- Review the proposed locations for flood defence works.
- Determine the nearest sensitive receivers at each location.
- Identify potentially vulnerable structures within the vicinity of the proposed locations.

- Identify locations for a field survey in order to characterise the existing soundscape.

The areas under consideration for flood water storage were reviewed and in conjunction with aerial photography, the nearest noise sensitive receivers were identified. Following identification of the sensitive receivers a survey strategy was developed to characterise the existing baseline noise levels at the locations of the sensitive receivers. In addition, potentially vulnerable structures within the vicinity of the proposed locations were identified. The key considerations for each location were as follows:

- The proximity of sensitive receivers to the proposed works
- The existing noise sources / noise levels
- The presence of any potentially vulnerable structures

11.3 Baseline / Receiving Environment

Following a desktop analysis of available aerial & street photography, the following potential noise sensitive receivers have been identified:

11.3.1 Location 1 - waterfront either side of the Graiguenamanagh to Tinnahinch bridge

Properties on the waterfront are sensitive to noise and vibration associated with any works being caried out on the river at this location. The existing noise levels in this area will likely be dominated by road noise from the R703 road which passes over the bridge and the weir located on the south westerly side of the Graiguenamanagh Tinnahinch Bridge.

There are a number of potentially vulnerable structures on the waterfront at location 1. Firstly, the Bridge itself is over 250 years old and may be vulnerable to excessive vibration. There are also a number of ruins and stone buildings on the waterfront as well as Tinnahinch Castle to the southwest of the Graiguenamanagh Tinnahinch bridge. The potentially vulnerable structures are described in Table 11-1 and shown, with the location of sensitive receivers, in Figure 11-2.

Table 11-1 Potentially Vulnerable Structures at Location 1

Structure name	Description
Graiguenamanagh Tinnahinch Bridge.	Stone bridge more than 250 years old, may be sensitive to vibration
Ruins.	Ruins on the waterfront adjacent to the Graiguenamanagh Tinnahinch bridge, may be sensitive to vibration.
Stone building.	Stone building on the waterfront at Graiguenamanagh, may be sensitive to noise and vibration.
Derelict building.	Derelict building at the waterfront, may be sensitive to vibration.
Waterfront shops/residential property.	Residential and commercial properties on the waterfront at Graiguenamanagh residents and patrons may be sensitive to noise and vibration.

Structure name	Description
Tinnahinch Castle.	Tinnahinch Castle, may be sensitive to vibration.

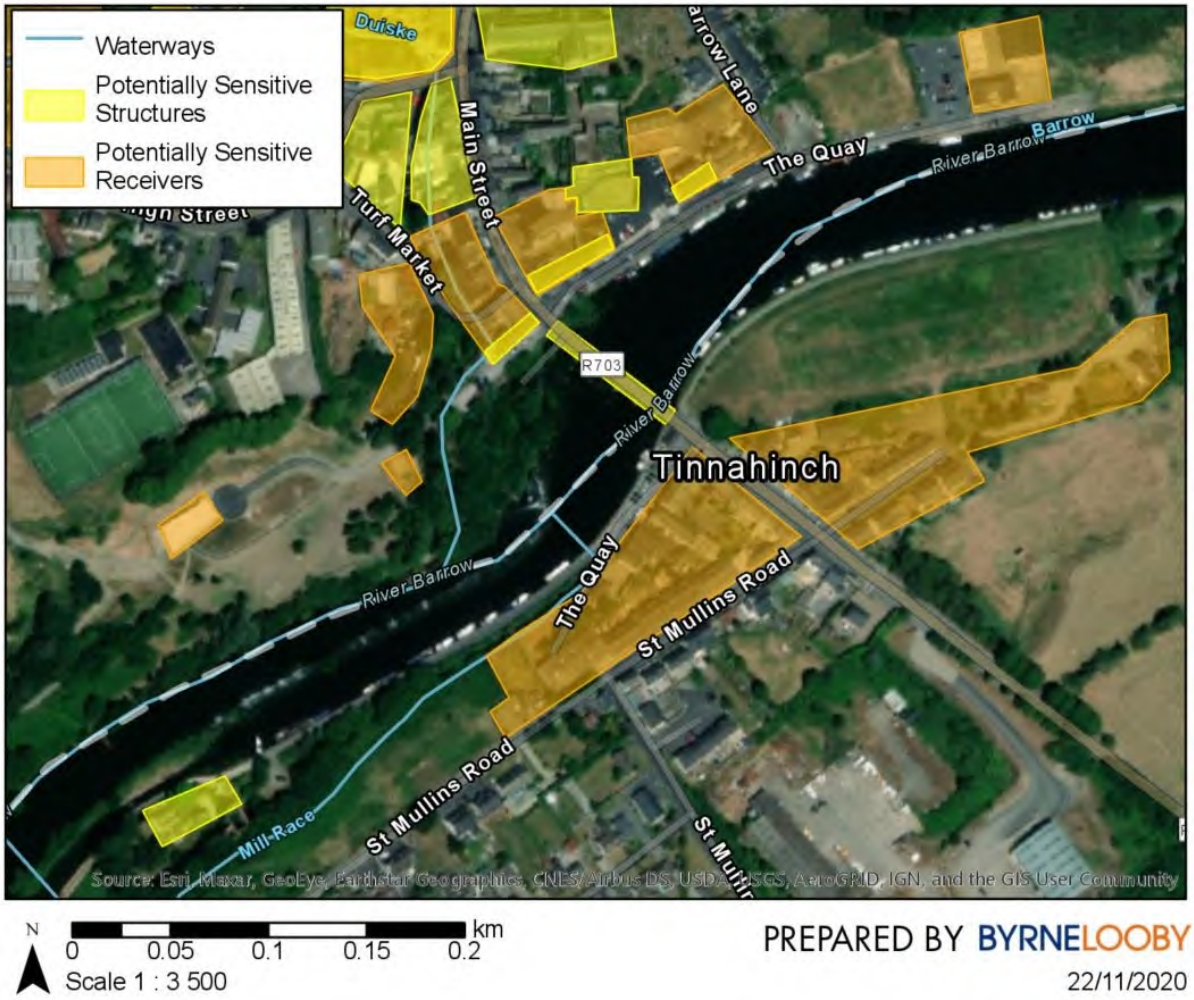


Figure 11-2 Sensitive Receivers and potentially vulnerable structures at location 1

11.3.2 Location 2 - the town of Graiguenamanagh

Within the town of Graiguenamanagh there are a number of potentially noise and vibration sensitive properties surrounding the potential locations of the water storage tanks.

There are a number of potentially vulnerable structures at Location 2. Firstly, a semi-collapsed building on Mill road. There is also a small bridge near the junction between Mill road and High street. The bridge appears to be as old or older than the aforementioned Graiguenamanagh Tinnahinch Bridge. The bridge spans a small confluence between the River Duiske and the Mill Race which runs in the direction of the Barrow, there are a number of properties which are above or immediately adjacent to the confluence which should be given due consideration as they may be vulnerable to excessive vibration.

The potentially vulnerable structures are described in Table 11-2 and shown, with the location of sensitive receivers and potential flood storage areas, in Figure 11-3.

Table 11-2 Potentially Vulnerable Structures at Location 2

Structure name	Description
Graiguenamanagh Mill.	Partially collapsed Mill building, may be sensitive to vibration.
Barrow tributary bridge and adjacent building.	A bridge spanning a tributary flowing down to the Barrow. The bridge itself would be sensitive to vibration. A number of residential buildings are overhanging the tributary and may be sensitive to noise and vibration.
Brick Chimney.	Brick chimney located adjacent to the Aldi entrance. May be sensitive to vibration.
Graiguenamanagh Abbey	Large Limestone Church, parts of the building constructed in the 13th century may be sensitive to vibration.
Clapper Bridge	Stone foot bridge.

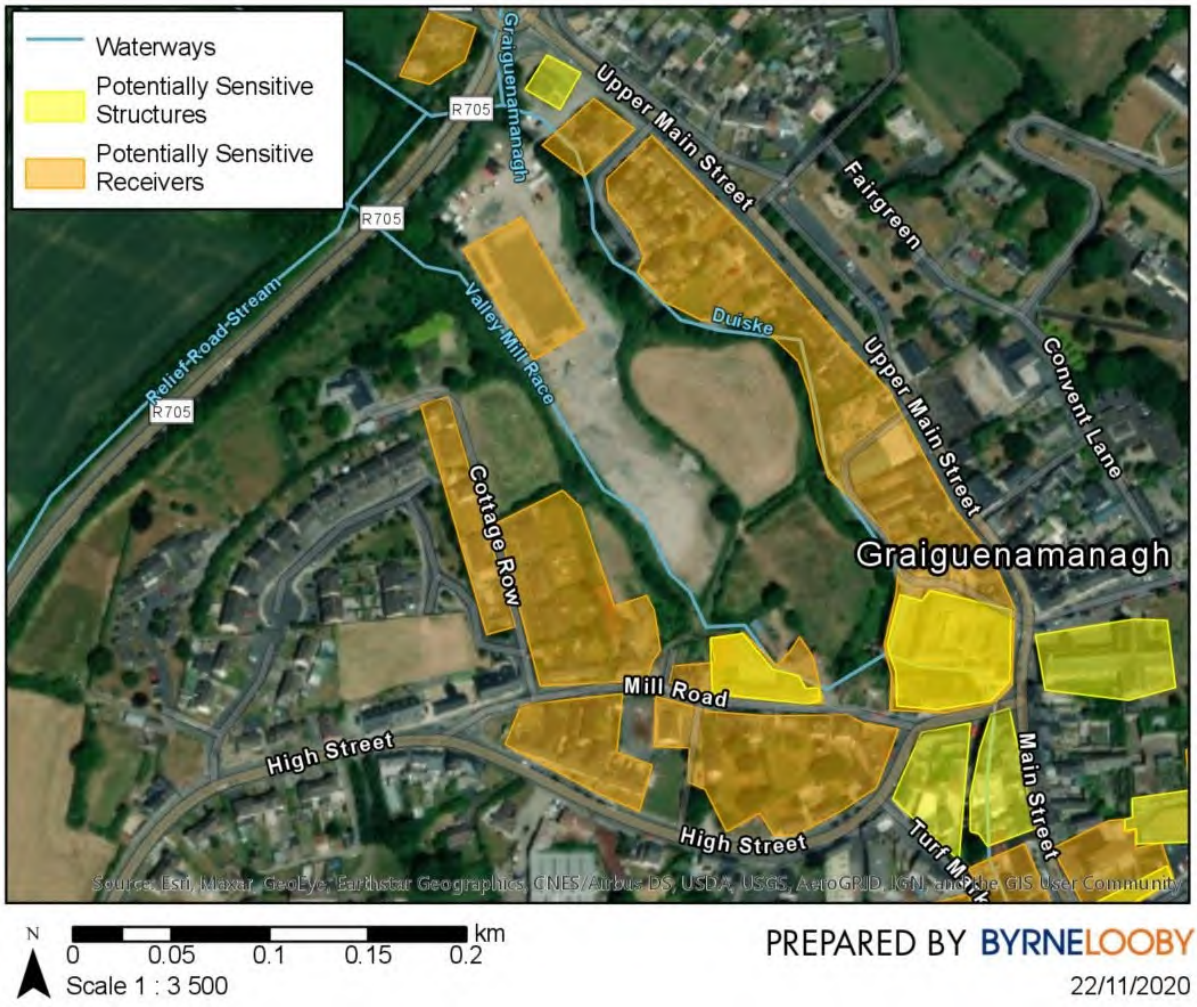


Figure 11-3 Sensitive Receivers and potentially vulnerable structures at location 2

11.3.3 Location 3 - residential properties on the outskirts of Graiguenamanagh

No vulnerable structures were identified by aerial or street photography available though a number of residential properties are within range of potential construction noise, these are marked as sensitive receivers in Figure 11-4. Noise levels at the properties would likely be dominated by the traffic noise from the adjacent road.

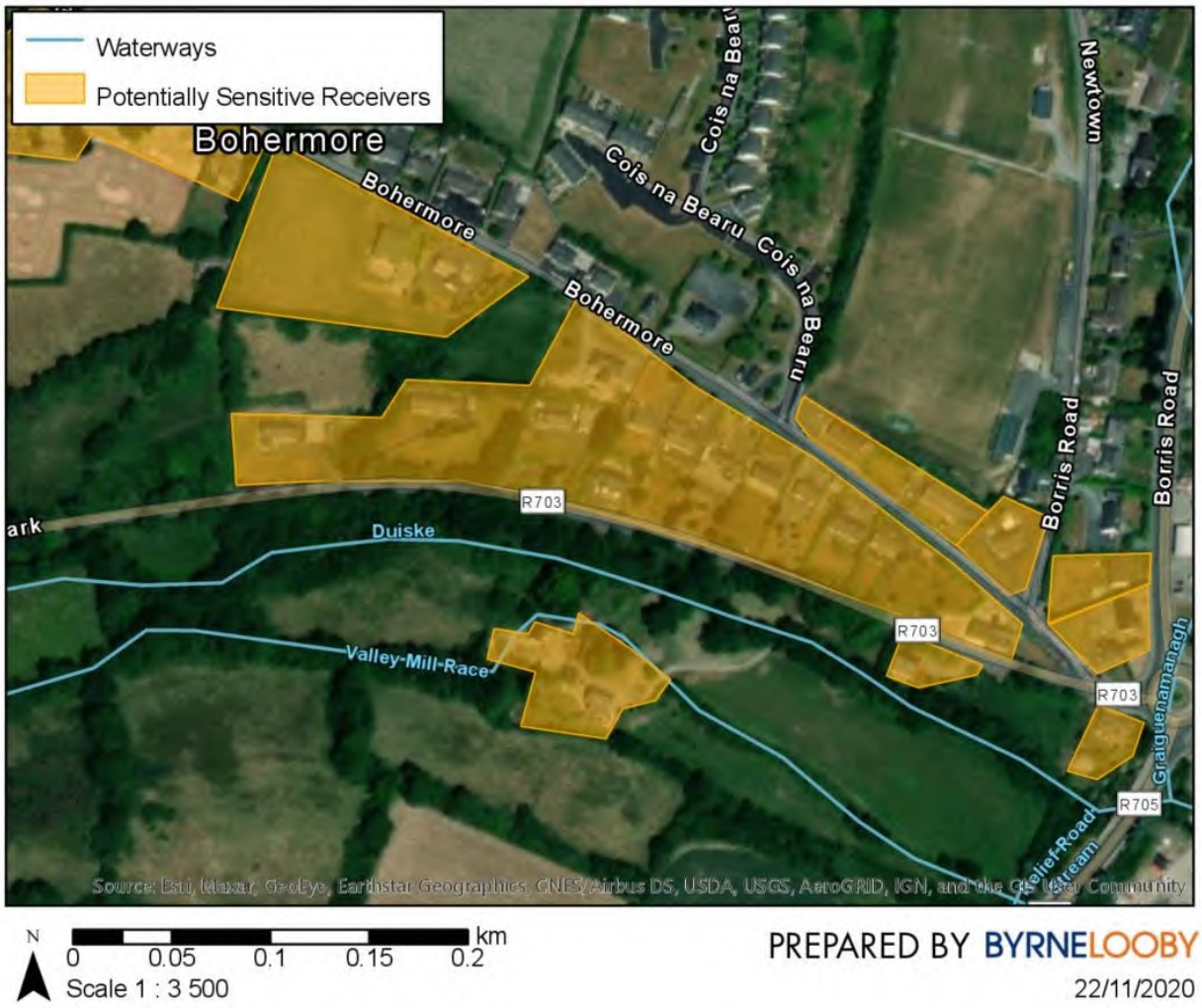


Figure 11-4 Sensitive Receivers at location 3

11.3.4 Location 4 - rural residential properties on the outskirts of Graiguenamanagh

Location 4 encompasses some of the same residential properties as location 3 as well as more rural residential properties further out of Graiguenamanagh within the potential audible range of construction of the proposed water storage locations. Once again road noise is likely to be the dominant noise source at this location. Sensitive receivers, and the potential locations of flood storage areas, are show in Figure 11-5.

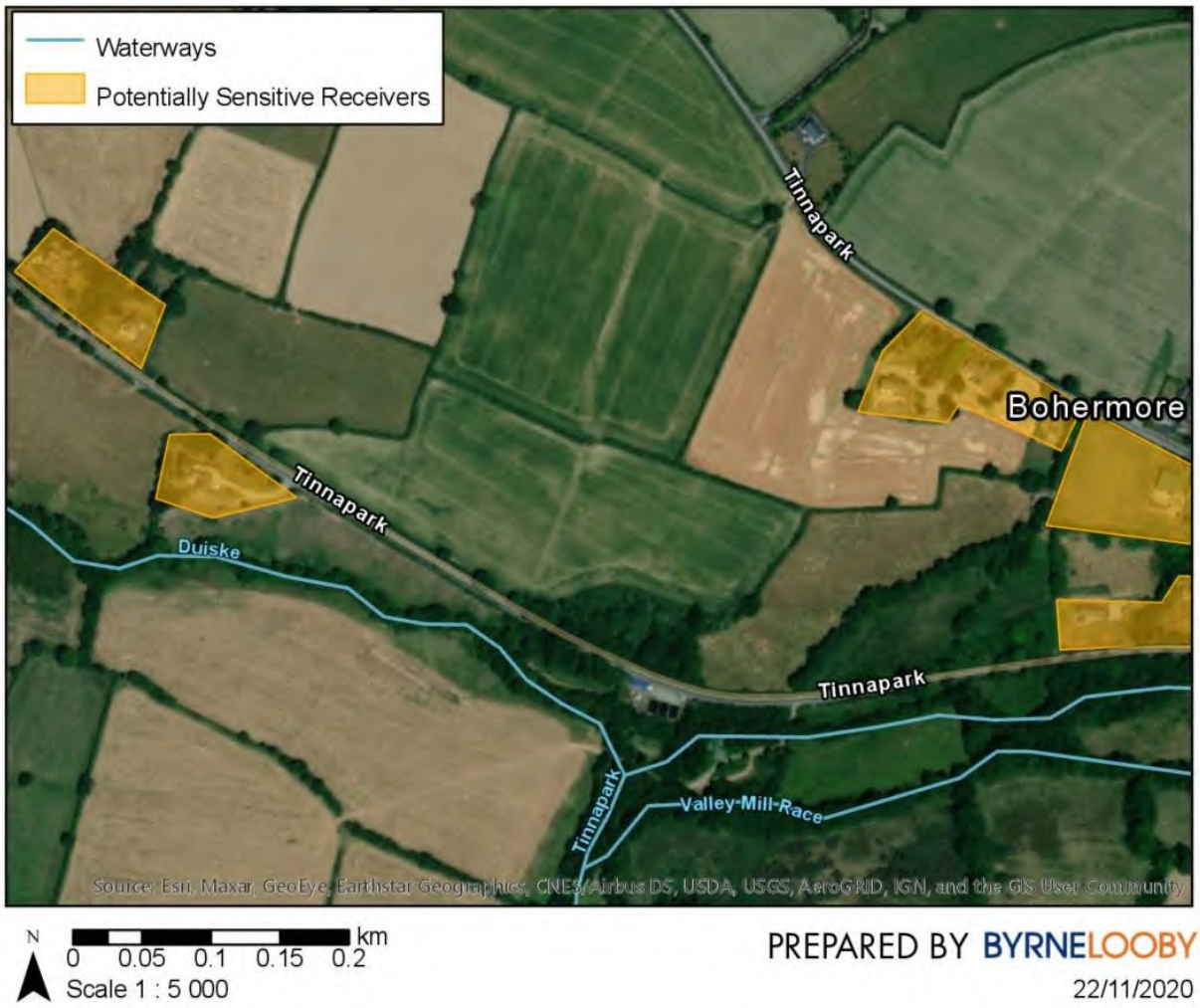


Figure 11-5 Sensitive Receivers at location 4

11.4 Methodology

A desktop study was undertaken to identify the key air quality constraints within the study area, specifically the areas surrounding the the towns of Graiguenamanagh and Tinnahinch.

The following sources of information were used in the preparation of this section:

- Draft Graiguenamanagh Tinnahinch Joint Local Area Plan 2020-2026.
- EPA Air quality index for health (AQIH)

11.5 Key Constraints

Noise and vibration effects are expected to occur during the construction phase only and would be expected to include:

- Construction traffic.
- Earthmoving plant and equipment.

- Sheet piling.
- Power tools and generators.

Construction noise is temporary in nature, and therefore the normal way of minimising the impact is to limit the working hours. The Local Authority may place noise limits on the construction works.

The project CEMP will include measures to avoid or minimise the potential impacts of noise on sensitive receptors during construction. The following noise control measures may be employed to limit noise impacts from the scheme:

- Install site hoarding 2.4 m high around site boundaries.
- Install local noise barriers with absorptive linings near to specific sources, during construction works.
- Provide enclosures around generators.
- Provide local screening.
- Implement appropriate noise management measures.

Ground-borne vibration attenuates rapidly with distance. People are very sensitive to vibration and can feel vibration long before it becomes an issue in terms of cosmetic damage or structural damage to buildings. Assessment of potential for damage due to vibration should be carried out where vulnerable structures are located in close proximity to works such as sheet piling.

A number of structures potentially vulnerable to vibrations associated with construction works have been identified in the vicinity of the proposed locations for hard defenses (in the preferred option of the CFRAM):

- Graiguenamanagh Tinnahinch Bridge;
- Ruins on the waterfront adjacent to the Graiguenamanagh Tinnahinch bridge;
- A stone building on the waterfront at Graiguenamanagh;
- A derelict building at the waterfront, may be sensitive to vibration;
- Waterfront shops/residential property;
- Tinnahinch Castle;
- Graiguenamanagh Mill;
- Barrow tributary bridge and adjacent building;
- A brick chimney located adjacent to the Aldi supermarket entrance; and

- Graiguenamanagh Abbey.

The scheme design and methods for works during construction should consider potential impacts to such structures and consider if there is a requirement for ongoing noise and vibration monitoring during construction.

12 Programme, Engineering/Design and Legal constraints

A number of constraints have been identified and reported above under the following topic headings:

- Resources and Materials.
- Socioeconomics.
- Hydrology.
- Soils, Geology and Hydrogeology.
- Ecology and Biodiversity.
- Cultural Heritage and Archaeology.
- Landscape and Visual.
- Air Quality.
- Noise and Vibration.

A summary of the key constraints identified for programme, engineering/design and legal considerations are described in this section.

12.1 Programme Constraints

- **Protected/notable species**. All works should be planned wherever possible to be carried out at times of the year that are ecologically least sensitive e.g. outside bird nesting (March – September) and fish migration periods (Spring/Summer, depending on species (see below)).
- **Otter**. If otters are found to be present and disturbance is likely then KCC must apply for a licence to allow proposed development works that might affect otters to proceed legally. The potential impacts on otter will be assessed and reported in the EIA. Otter mitigation works can potentially be conducted at any time of year but must avoid the breeding season (usually Spring but can be any time of year) if holts are present on site.
- **Red Squirrel**. Construction work is very unlikely to threaten red squirrel as no drey sites were recorded within the proposed scheme area. The potential impacts on this species will be assessed and reported in the EIA. Works affecting red squirrel habitat should be timed to avoid the breeding season (1st February – 30th September inclusive).
- **Pine Marten**. Construction work is very unlikely to threaten pine marten as no den sites were recorded within the proposed scheme area. The potential impacts on this species will be assessed and reported in the EIA. Works affecting pine marten habitat should be timed to avoid the breeding season (March - June inclusive).

- **Badger**. Although badgers have been recorded in the study area, no setts or field sign were recorded during the site visit. Construction work is very unlikely to threaten badger as no setts were recorded within the proposed scheme area. Should a badger sett be recorded within the scheme extents prior to construction works then appropriate mitigation and a licence for works will be required. Construction of new setts must be completed in Spring/Summer with blocking and destruction of existing setts completed in Autumn/early winter.

- **Bats**. The scattered mature trees, bridges, architecture (churches, masonry) and areas of low water flow provide good foraging, roosting and commuting routes for bat species in the area. Options that require the removal of mature trees or works to bridges or other riverine structures with the potential to support roosting bats shall be assessed for bat potential. Bat surveys shall be conducted on any features with medium or high potential for roosting bats. The optimal time to conduct map surveys are May and August, when bats are most active. If bats are found, they should not be disturbed during hibernation period (October to March) or maternity period (June to August). If a bat roost requires removal then a licence would be required. Removal of roosts should be carried out during the summer months for hibernation roosts and during the winter months for maternity roosts.

- **Freshwater Fish**. Fish present in the river include both brook and river lamprey *(Lampetra planeri and L. fluviatilis*) (O'Connor, 2017), brown trout (*Salmo trutta*), sea trout (Salmo trutta morpha trutta), stone loach (*Barbatula barbatula*), three-spined stickleback (*Gasterosteus aculeatus*) and eel (*Anguilla anguilla*). Salmon (*Salmo salar*) have been recorded in the river's lower course. In terms of the construction programme, it should be noted that in salmonid catchments, in-stream works are not permitted between the months of January to April (migration) and October to December (spawning). This corresponds with guidance from Inland Fisheries Ireland.

- **Lamprey**. Lamprey (both species) spawning takes place in the spring and early summer period in often the same habitats where salmon and trout spawn. The spawning season for brown and sea trout is November to February. If spawning grounds are found to be present in the construction zone for the scheme then this period should be avoided.

- **White-clawed Crayfish**. Any works carried out on the riparian habitat and banks should where possible be restricted to between July and October as this is a period when white-clawed crayfish are less sensitive, with females already having released their young and individuals being more active and not seeking refuge deep in bankside burrows as they do in winter months.

- **Invasive species**. Japanese Knotweed, Himalayan balsam, and Gunnera are listed as invasive plants under the EC (Birds and Natural Habitats) Regulations 2011 (S.1. 477/2011). These regulations prohibit the introduction or dispersal of invasive species and appropriate measures should be undertaken in the proposed scheme development. Therefore, any works occurring in areas where invasive species are present must use appropriate measures.

- Any in-river works will need to ensure compliance with the WFD.
- Co-ordination of any in-river works with the IFI and adherence to any IFI requirements.
- The presence of previously un-recorded underwater archaeological artefacts may significantly slow down the construction programme.
- The application for derogation licences should be applied for in advance of any works which may disrupt any protected species.
- Replies to requests for further information/clarification from An Bord Pleanála.

12.2 Engineering/Design Constraints

- The design of the final scheme may be subject to a number of site investigations and may change depending on the findings of these investigations.
- The made ground is uncompacted and highly variable may require excavation and replacement with suitable founding material.

12.3 Legal Constraints

- A 3rd party challenge to the application to An Bord Pleanála and a request for an oral hearing.
- All works must comply with all national and international laws and treaties as mentioned in the relevant sections of this report as well as the environmental reports provided as appendices. Compliance with relevant European Directives (EIA Directive, Birds Directive, Habitats Directive, Water Framework Directive, etc) and the instruments transposing these into Irish Law will be required.
- Screening for EIA and AA will be undertaken in line with national and international laws, and using:
    - appropriate specialist topic-specific guidance.
    - national and EU guidance for environmental assessment.

  The outcome of these assessments will inform the requirement for further environmental assessment. It is understood on the basis of information available at the time of writing that AA/NIS and EIA will be required.

  An EIA Scoping Report will be prepared in Spring 2021.

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