Eirspan TO 302 N78 Castlecomer Footbridge Options Report

July 2019

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CASTLECOMER FOOTBRIDGE

Options Report

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EXECUTIVE SUMMARY

STRUCTURE

Name:	N78 Castlecomer Footbridge
Structure Ref No:	Existing KK-N78-008.00 Castlecomer Tributary Bridge
Primary Function:	To provide a new pedestrian link on the River Dinin adjoining the N78,
Check Category:	2
Loading:	IS EN 1991 – LM4
PASSAGES	
Primary:	Number: N78
Name:	Henebry's Cross, Co. Kilkenny – Castlecomer – Ballitore, Co. Kildare
Secondary:	River Dinin

RECOMMENDATION

The outcome of the options study indicates that a two-span steel box girder footbridge (Option 4) with a timber deck should be considered as the preferred option. It is recommended that Option 4 is taken forward to planning stage as the preferred option.

ESTIMATED COST

The estimated works cost of the pedestrian bridge is approximately €902,000 excluding VAT (2019).

Contents

Tables

Figures

Appendices

1 INTRODUCTION

1.1 Consultant's Brief

RPS was commissioned by Kildare County Council National Roads Office (KNRO) acting as Lead Authority under a Section 85 Agreement[1] with Kilkenny County Council (KCC) under Eirspan Task Order 302 to provide technical consultancy services to examine options for an improved pedestrian link across the River Dinin in Castlecomer, Co. Kilkenny. RPS will also provide technical consultancy services to develop the preferred option from preliminary design through to construction and handover.

1.2 Background to the Scheme

The existing River Dinin Bridge was constructed in 1767 and it is approximately 6.7m wide between parapets (see Figure 1-1 & 1-2). It caters for both vehicular and pedestrian traffic movements on the N78. As the bridge was constructed in 18th Century it was never intended to cater for modern vehicular traffic consequently the existing bridge is too narrow to cater for a safe modern road cross section complete with footway.

Figure 1-1: Elevation of North Side of existing N78 Castlecomer Bridge from Castlecomer Discovery Park

[1] Section 85 of the Local Government Act 2011 available on www.irishstatutebook.ie

Figure 1-2: View Eastwards along existing N78 Carriageway crossing the Castlecomer Bridge

There is only one footpath on the existing bridge which is sub-standard and varies 650-900mm in width. It is hazardous for both road users and pedestrians particularly on the east end of the bridge where the turning movements of HGV's encroach on the footway due to the tight bend in the road. In order to improve safety at the location KCC intend to remove pedestrians from the existing bridge and provide a new dedicated facility for pedestrians to cross the Dinin.

The need for improved pedestrian links over the River Dinin has been previously identified in the Castlecomer Local Area Plan (LAP) 2009 -2018 and more recently has been identified as key objective in the Castlecomer Local Area Plan 2018-2024 under the following headings:

Recreation, Tourism and the Arts – Strategic Walking and Cycling Routes

RTA1 to provide pedestrian linkages at the following locations:

- PL 1 - between the Discovery park and the town centre via a new pedestrian bridge over the River Dinin
- PL2 -Castlecomer Discovery Park and the Prince grounds (pedestrian bridge over River Dinin required)
- PL3 - Between the Acorns (Upper and Lower) and Donaguile subject to consultation with the Local Community
- PL4 - Along the River Dinin between the Athy road N78 bridge and the former Convent along the Kilkenny road, with a branch linking through the lane central to Florence terrace

Transport

- T6 - To facilitate and support the provision of a pedestrian link across the River Dinin from the Discovery Park into the town.

1.3 Previous Studies

Previous studies conducted to date:-

- Castlecomer Local Area Plan 2009 – 2018 - Kilkenny County Council
- Castlecomer Local Area Plan 2018 – 2024 - Kilkenny County Council
- Pedestrian Bridge on the River Dinin at Castlecomer, Co. Kilkenny - Feasibility Report - Kilgallen & Partners (January 2018)
- Topographical Survey (IO Geomatics) 2018

1.4 Site Location

The site of the proposed pedestrian bridge is on the eastern side of Castlecomer town, Co. Kilkenny on the N78 crossing of the River Dinin bridge, see Figure 1-2. The Archaeological and Historical background to the Castlecomer town and the bridge are presented in the Cultural Heritage Assessment prepared by John Cronin & Associates in Appendix D.

Figure 1-3: Site Location

2 CONSTRAINTS

There are a number of constraints to be considered in the study area, an overview of the constraints is presented below.

2.1 Physical Constraints

2.1.1 Existing N78 Castlecomer Bridge

The existing N78 road bridge is the primary impediment to the provision of a safe pedestrian link across the River Dinin. The existing bridge is narrow, being only 6.7m wide between inside face of parapets. The absolute minimum width required for a new road bridge to current standards with a footway one side is 9.4m. This would consist of a 7m carriageway, 1.8m footpath and 0.6m raised verge, although it would likely be well in excess of this in reality. Consequently, it is evident that as the current bridge does not provide an adequate vehicular cross section and any improved pedestrian link will need to be provided outside the envelope of the existing bridge.

Figure 2-1: View Eastwards along existing N78 Carriageway crossing the Castlecomer Bridge

2.1.2 River Dinin

The existing watercourse provides a significant physical constraint due to the width of the watercourse, the presence of the weir and that the site is located at the confluence of the Dinin and one of its tributaries. The combination of these factors is a particular issue for an independent bridge as it constrains the locations where the new bridge can be supported.

Figure 2-2: River Dinin

2.1.3 Proposed Alignment & Location

The proposed alignment of a new bridge must present as the most desirable link for pedestrians to cross the Dinin and not deviate too far from the desire line. The desire line is the pedestrian's most desirable way to cross the river, typically the shortest distance. The desire line for crossing the river runs east-west roughly adjacent to the existing bridge. If the bridge was located further north, it would could result in the perception that it was a longer distance to cross the river resulting in pedestrians reverting to using the existing bridge.

2.1.4 Land Requirements

The land on the west bank of the river is privately owned and it is intended to progress the scheme by agreement. The landowner's primary concern is maintaining their privacy which is currently provided through a combination of a substantial boundary wall and a screening of mature trees. They also want to minimise their loss of property. This restricts the location of the western landing point of the bridge to within approximately 8m of the existing boundary wall in order to avoid removing the screen of large trees. The boundary wall at this location is part of the curtilage of the adjoining property which is a protected structure.

The land on the east bank of the river is of significant amenity value as it forms part of the Castlecomer Discovery Park and there are a large number of mature trees present and any works in this area could adversely impact them. The Castlecomer Discovery Park do not want a direct uncontrolled assess to the park consequently any proposal will be required to connect pedestrians to the existing footpath on the N78 east of the river.

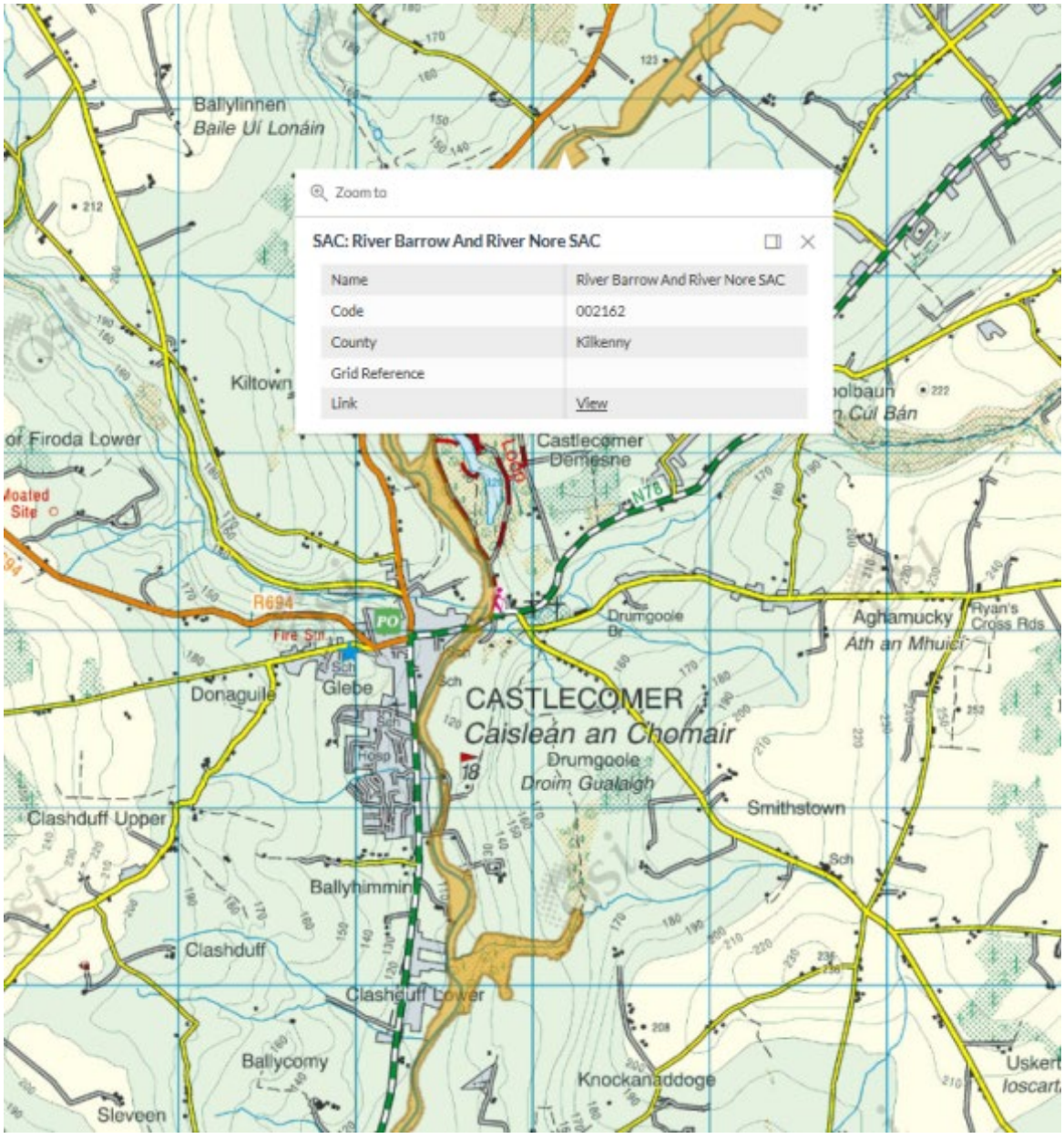
There is also a small area of scrub land between the Dinin and its tributary that is not readily accessible from the road and the Discovery Park that does not offer any significant amenity presently. The major constraint on the east bank is locating the bridge so that it connects directly to the existing footpath on the N78 such that there is minimal impact on the Discovery Park.

2.2 Environmental Constraints

2.2.1 River Barrow and River Nore SAC

The primary environmental constraint at this location is the Dinin River. The site is situated within the River Barrow and River Nore Special Area of Conservation (SAC) and within 15km of the Lisbigney Bog SAC and upstream of the River Nore Special Protection Area (SPA) (see Figure 2-3). The most prevalent qualifying environmental feature that will impact on the scheme is from the Salmonid habitats in the River Dinin associated with the River Barrow and River Nore SAC. Consequently, careful consideration of the environmental impact of the scheme shall be required.

Figure 2-3: Extent of the Adjoining SAC



In light of the Salmonid Habitat, instream construction works shall only be permitted from July to September.

2.2.2 Conservation Status of the Existing Bridge & Environs

The existing bridge structure is largely original except for masonry repairs to parapets. The bridge and adjoining walls are of significant importance to the built heritage locally in Castlecomer and in Kilkenny. It is a protected structure and is included on the Record of Protected Structures (RPS Ref. no. D13) within the current Kilkenny County Development Plan. The bridge was rated as being of National importance in the National Inventory of Architectural Heritage (NIAH no. 12301001) survey of bridges and other historic structures in County Kilkenny. The NIAH records the bridge as follows:

"Five-arch road bridge over river, built 1763. Part creeper- or ivy-covered walls centred on granite ashlar triangular cutwaters to piers having pyramidal capping with lichen-spotted cut-granite stringcourses supporting parapets having lichen-spotted cut-granite coping. Series of five round or segmental arches between round-headed niches with rusticated granite ashlar crow stepped voussoirs centred on lichen-spotted cut-granite triple keystones. Sited spanning Dinin River with wooded banks to river."

It includes an appraisal of the bridge's merits as follows:

"A bridge erected by George Smith representing an important component of the mid eighteenth-century civil engineering heritage of County Kilkenny with the architectural value of the composition, one succeeding a bridge washed away during the so-called "Great Flood of 1763", confirmed not only by the silver-grey granite dressings demonstrating good quality workmanship, but also by the elegant "sweep" of the arches making a pleasing visual statement at a crossing over the Dinin River: meanwhile, a benchmark remains of additional interest for the connections with cartography and the preparation of maps by the Ordnance Survey (established 1824)."

Because of its heritage significance, replacement or widening of the existing bridge is not considered appropriate. The aesthetics of the new link needs to be carefully considered and be sympathetic to the aesthetics of the existing structure as well as the aesthetics of the overall area.

The aesthetics of any alteration to the existing bridge or the provision of a new bridge must be carefully considered when viewed from the river bank to the north in Castlecomer Discovery Park as this is the primary viewing point of the bridge. The provision of any form of new pedestrian link will impinge on the vista of the existing bridge; however, it should not excessively detract from or contrast excessively with the existing vista. Considering this, the new structure should not be a signature or statement bridge and should have a low profile.

It should also be noted that while a new link will impinge on the vista from the discovery park it will allow the existing bridge to be viewed close up from either a new standalone bridge or attached walkway.

The site is also located within the zone of notification for the Historic town of Castlecomer (RMP no. KK005-082--) and is also immediately adjacent to the Battlefield site (RMP no. KK005-102---). In addition, the adjoining property is a protected structure under the Kilkenny County Development plan (Ref C491) and recorded on the NIAH 12301002. The boundary wall that adjoins the bridge from the west is considered part of the curtilage of the protected structure.

2.3 External Constraints & Design Parameters

2.3.1 Design Parameters – Geometric

The primary design parameter is to provide a pedestrian crossing with a minimum width of 2.5m. The desirable maximum gradient is 1:20. The existing topography near the site is generally favourable, although there is an approximate level difference of 1.5m between the ground level on the east and west side of the bridge where the approach ramps will tie into the existing pedestrian facilities.

This poses an issue with minimising the footprint of the scheme for the landowners on the west side as it will result in the boundary wall being realigned as far as their existing gate. It also poses a challenge with maintaining a maximum gradient of 1:20 on the western approach whilst trying to ensure that the soffit of the new bridge clears the soffit of the existing bridge's western arch.

2.3.2 Design Parameters – Structural

The proposed structure shall be designed in accordance with Eurocodes and the TII Design Manual for Roads and Bridges (DMRB), which both specify a design life of 120 years. It will be designed for pedestrian loading in accordance with IS EN 1991-2, load model LM4. A Technical Acceptance Report (TAR) will be prepared in accordance with TII DN-STR-03001 (formally NRA BD2/09), where all the relevant design parameters will be listed.

All pedestrian bridges should be categorized into bridge classes by their usage to determine the appropriate dynamic actions to be considered due to pedestrians. In consultation with Transport Infrastructure Ireland (TII) who are the Technical Approval Authority for the bridge, and who will subsequently be responsible for the maintenance of the bridge, the bridge class has been identified as Class C in accordance with Cl. NA.2.46.2 of IS EN 1991-2:2003 (National Annex).

This class is suitable for urban routes subject to significant variation in daily usage (e.g. structures serving access to offices or schools). The performance class has been selected based on the potential for future developments that may occur east of the existing town extents within the 120 year design life of the structure that cannot be reasonably foreseen at this time. In addition, given the popularity of the Discovery Park, the redevelopment of the hotel, the emerging popularity of park runs there is potential for significant pedestrian activities to occur and the exact nature of these activities cannot be readily quantified or guaranteed at this time.

The number and nature of pedestrian users on a footbridge results in the footbridge becoming 'excited'[2], the scale of the excitations is a function of the type of bridge, span, structural depth (inertia), materials and nature of the pedestrian usage i.e. groups of people jogging/running etc. Generally, the intent is to have minimal or no perceptible dynamic response however in longer span bridges where the intent is to provide a slender solution with aesthetic merit, a balance between acceptable dynamic behaviour and the slenderness of the structure is required. While it is not envisaged that there will be regular athletic events across the bridge it may be the subject of an annual event in years to come.

As the proposed structure will form a pedestrian link, the parapet height shall be a minimum of 1.25m high in accordance with TII DMRB requirements.

2.3.3 Construction Phase

During the period of construction, it is anticipated that there will be some disruption to the existing N78 due to the construction of the proposed pedestrian bridge. There will be disruption to traffic during works at both ends of the bridge to accommodate the alteration to the existing bridge or the provision of a new bridge. It is not considered feasible to close the N78 for an extended period to facilitate the scheme as there is no suitable alternative route. A short duration closure may be feasible or the provision of one way stop go systems to allow works adjoining the existing carriageway.

2.3.4 Stakeholders

There are a number of stakeholders to consider as part of the scheme. Stakeholders to the project include:

- Transport Infrastructure Ireland as the funding body and the agency responsible for future maintenance of the structure.
- Kilkenny County Council as the asset owner and one of the bodies responsible for delivering the bridge.

[2] An example of a bridge that is subject to significant excitations is Daly's Bridge in Cork, colloquially known as the "Shaky Bridge". It is a pedestrian suspension bridge constructed in 1927 and is presently subject to significant dynamic excitations. While the bridge is still functional and not at risk of collapse, the magnitude of the excitations is such that it does not present as safe to the user and general public. The magnitude of the dynamic excitations are in excess of what would be permitted under modern design standards.

- Castlecomer local community and visitors as the primary end user.
- Neighbouring private property owner to the west – minimise footprint on property adjoining the west abutment.
- Castlecomer Discovery Park – to the north of the bridge.
- Office of Public Works – responsible for the hydraulic impact of the structure.
- Inland Fisheries Ireland and the National Parks and Wildlife Service for protection of the aquatic and terrestrial environments.
- Service providers with utilities in the vicinity (see section 2.3.5)
- Castlecomer Development Association – Owner of the lands on the east bank.

2.3.5 Utilities[3]

There are a number of known utilities in the vicinity of the bridge:

- Buried Eir Services.
- Buried watermain.
- Overhead electrical lines feeding the lighting columns east and west of the existing bridge.

2.3.6 Hydraulic Constraints

The existing structure and the weir are the primary hydraulic constraints in the river channel. The existing channel is very wide and the 1:100-year flood level (1% AEP) is 113.36m. This represents a flood level roughly at the springing point of the arches. The 1:1000-year flood level (0.1% AEP) is 113.76m.

OPW recommends a minimum 300mm freeboard above the 100 year (1% AEP) level to the soffit of any new structure. All flood levels quoted include a 20% allowance for climate change as per OPW guidelines.

[3] The exact nature and location of buried services will be confirmed during site investigation works.

3 OPTIONS FOR THE PROPOSED CROSSING

Options for the crossing were developed by RPS Consulting Engineers and Powell-Williams Architects in conjunction with input from TII, Kildare County Council and Kilkenny County Council. The brief specified that the following types of crossing should be considered:

- A standalone structure;
- A structure connected to the existing road bridge.

The brief also specified that a variety of material should be considered:

- Steel;
- Concrete;
- Glulam;
- Composite Materials.

The brief stated a number of design options for the footbridge should be examined and an options report which considers at least five options should be produced. All of the proposed footbridges should be sympathetic to the local surroundings, noting that the existing bridge is an attractive masonry arch structure. Options should take into consideration all relevant factors such as aesthetics, cost, impact on protected structure, impact to road and river traffic etc.

There were a number of constraints which influenced the development of the options and these are outlined in detail in Section 2 of this report. In summary, the primary constraints include:

- A requirement for a cross sectional width of 2- 2.5m for pedestrians;
- A requirement that any pier required for a new footbridge avoids the existing weir;
- A requirement that there are no adverse impacts on the Barrow and Nore SAC;
- A requirement that the view of the elevation of the existing bridge from Castlecomer Discovery Park is preserved as much as possible;
- A requirement to provide a cost-effective solution with aesthetic merit;
- A requirement to provide a structure with minimal maintenance requirements;
- A requirement to minimise impact on the landowners on the east and west banks.

3.1 Structural Forms Considered

In considering what the preferred solution may comprise, a variety of structural forms for a standalone independent footbridge were considered in an initial scoping exercise with several of them being discounted for a number of reasons:

- Single span through arch bridge; - The overall span length of the bridge would be in the region of 40-50m. In order to provide a suitable structural configuration for an arch bridge, the resulting elevation of the bridge would obscure the majority of the existing bridge elevation. It would also have issues with obtaining consent from the Office of Public Works due to the location of arch members, consequently it was not considered further.

- Single span high arch bridge - The overall span length of the bridge would be in the region of 40-50m. In order to provide a suitable structural configuration for the bridge, the height of the arch would result in a visually obtrusive structure that would not fit with the adjoining landscape.

- Cable stay bridge - The overall span length of the bridge would be in the region of 40-50m. The height of towers required for a cable stayed structure would not fit in with the adjoining landscape.

- Stress ribbon bridge - A stressed ribbon bridge would have significant aesthetic merit as it would produce a slender and low-profile structure. However, the existing string course/top of parapet is on a crest profile on elevation whereas a stress-ribbon bridge would present a sag on elevation and would contrast adversely with the existing elevation. In addition, the construction costs would be in excess of 1.5 times that of a comparable steel or concrete structure. To date only one stressed ribbon bridge has been constructed in Ireland.

- In-situ concrete bridge – A concrete bridge with a span length of 40-50m would require the use of post-tensioning in order to achieve a proportioned structure with aesthetic merit. However, this would have significant cost implications as post-tensioned bridges are no longer common in Ireland. In addition, this would require a significant amount of formwork and temporary works in order to facilitate construction along with a significant concrete pour over the watercourse.

- Composite materials (fibre reinforced polymer/steel-concrete composite) – The use of non-standard materials was discounted due to aesthetics, cost and durability concerns. The spans required in this instance would be out of reach for a composite fibre reinforced polymer deck without support from cables/arches etc. A steel-concrete composite was discounted as it would also require in-situ concrete works and significant shuttering over an environmentally sensitive watercourse.

After extensive discussion with the clients Kilkenny County Council, Kildare NRO and TII it was decided to pursue five principal options.

1. Cantilever Structure;

2. Single Span Steel Box Girder;

3. Two Span Timber Glulam;

4. Two Span Steel Box Girder;

5. Single Span Steel Truss with Glulam Deck.

General arrangement drawings, photomontages and scheme drawings of the proposed options are presented in Appendix A.

3.2 Option 1 – Cantilever Structure

This option would entail the provision of a new cantilever structure (supported by struts) attached to the existing bridge to provide the proposed pedestrian link. This solution has been used on numerous occasions in Ireland, examples are outlined below in Figures 3-1 and 3-2. This option would potentially require works across the existing carriageway to provide a dead-end anchor or tie bar to restrain the walkway along the elevation of the bridge.

Figure 3-1: Anna Liva Bridge, Dublin [Image copyright Roughan O'Donovan Ltd.]

Figure 3-2: N22 Macroom Footbridge Co. Cork [Image copyright John Craddock Ltd]

Figure 3-3: Option 1 – Cantilever Walkway Photomontage

3.3 Option 2 – Single Span Steel Box Girder Footbridge

The single span steel box girder footbridge option represents a feasible option with an uncomplicated structure which maintains views of the masonry arches of the existing masonry arches from Castlecomer Discovery Park. The bridge has a significant structural depth due to the long span and to ensure it satisfies dynamic performance requirements.

Figure 3-4: Option 2 – Single Span Steel Box Birder Footbridge Photomontage

3.4 Option 3 – Two Span Timber Glulam Footbridge

A two-span timber glulam beam footbridge presents another feasible option. The pier location will be aligned with one of the existing piers of the masonry arch bridge to minimise the hydraulic impact of the new structure. It will also help to preserve the clear spans between the arches. The eastern and western spans will be approximately 19 and 28m respectively. A two-span bridge with an intermediate support allows for a reduced structural depth which in turn reduces the visual footprint of the structure on elevation, albeit the provision of the pier will impinge on the view of the existing bridge.

Figure 3-5: Option 3 – Two Span Timber Glulam Footbridge Photomontage

3.5 Option 4 – Two Span Steel Box Girder Footbridge

The two-span steel box girder footbridge presents similar attributes to the two-span glulam bridge. However, as steel has a much higher strength to weight ratio than timber, the structural depth can be reduced further resulting in a smaller visual footprint on elevation.

Figure 3-6: Option 4 – Two Span Steel Box Girder Footbridge Photomontage

3.6 Option 5 – Single Span Steel Truss/Glulam Deck Footbridge

A single span steel truss footbridge with a glulam deck presents another viable and attractive option. It takes the structural efficiencies of a steel truss and couples it with the aesthetic merits of a timber glulam structure. In addition, the glulam also provides additional mass to the structure to improve the dynamic performance of the structure.

Figure 3-7: Option 5 – Single Span Steel Truss/Glulam Deck Footbridge Photomontage

4 TECHNICAL EVALUATION

4.1 Option 1 – Cantilever Structure

The Cantilevered solution provides a reasonable technical solution however there are several issues with the solution.

4.1.1 Option 1 – Advantages

This option meets the design criteria and presents a limited visual intrusion on the existing structure in so far as possible. The struts and walkway will not affect the view of the existing masonry arches from Castlecomer Discovery Park. They will however impinge on the composition of the entire bridge elevation. The relative aesthetic merit will be discussed further in later chapters. The struts will be placed in line with the existing piers and the clear spans of the arches will be preserved. The cantilever maintains the existing access and headroom under the structure and the alignment minimises the amount of land taken by the new bridge.

4.1.2 Option 1 – Disadvantages

The cantilever needs to provide a 2.0m wide cross section for pedestrians to satisfy the brief which results in a cross section of 2.5-2.7m allowing for pedestrian parapets. This is a substantial cantilever with most of the precedents for this type of construction usually being approximately 1.5m wide. The geometry of the cantilever will be out of proportion in the context of the overall bridge as the bridge is currently 7.5m wide and the provision of a cantilever of 2.7m width will represent a 35% increase on the overall width of the existing bridge.

The cantilever will need substantial support from the existing bridge in the form of a buried anchorage or tie bar to support the main deck. This will involve some demolition of the existing spandrel wall and excavation of the carriageway between the arches to construct the anchorages. This will be difficult to achieve whilst maintaining live traffic on the bridge. The architecture of the bridge could also be adversely affected during this work.

There is also the issue of vehicular containment. The parapet wall may contain a vehicle in an impact however the force of the impact is likely to damage the structural members on the cantilever.

In addition, while the cantilever is quite slender in appearance and allows the view of the existing bridge to be maintained, it will significantly alter the character of the existing bridge. Given it is a protected structure; it is unlikely that this option will be favoured from a built heritage conservation perspective.

4.1.3 Option 1 – Risks

This option involves at least some demolition and modification to the existing stone arch bridge. Whilst this has been done many times on other similar projects, there is always an element of uncertainty associated with an old stone bridge.

As previously noted, there is a risk associated with the removal of part of the parapet on the approach to the existing bridge at each end. This can be mitigated through design and a suitable solution developed but there remains a risk that the aesthetics will not match the character of the existing parapet.

4.2 Independent Footbridge Options

The independent footbridge options are:

1. Single Span Steel Box Girder;
2. Two Span Timber Glulam Beam;
3. Two Span Steel Box Girder;
4. Single Span Steel Truss/Glulam Deck.

These options provide technical solutions to satisfy the constraints outlined in Section 2 and all the requirements of the brief.

The alignment of the independent footbridge needs to strike a balance of remaining as close as possible to the existing bridge, whilst also allowing sufficient clearance to maintain visibility of the masonry arches and allowing architectural independence. As previously noted, it is important that the alignment of the pedestrian path stays as close as possible to the desired line across the river.

The location of the independent bridge solution has been chosen to allow a smooth flow of pedestrian traffic. The pedestrian bridge will not deviate significantly from the route of the existing bridge and will allow a smooth flow of pedestrian traffic across the River Dinin.

With the above in mind, a clear gap of 3m has been adopted as a minimum on the west side increasing to approximately 15m on the east side. This ensures that the new structure can be clearly seen as independent of the existing and maintains a suitable separation that would discourage anyone from jumping across between the two bridges.

4.2.1 Independent Footbridge Advantages

An advantage of these options over the cantilever structure is avoiding excessive works to an old masonry arch bridge. These options will also avoid major disruptions to traffic during construction, with works only required at either end of the existing bridge as opposed to along the entire length of the narrow bridge.

The independent footbridge can be constructed with minimal impact on the existing bridge, utilities or road traffic. As a trade-off, the independent footbridge option will span a longer overall length than the existing masonry arch bridge.

4.2.2 Independent Footbridge Disadvantages

All options require in-stream works to construct an independent footbridge and in the case of the two span options, an intermediate pier will need to be introduced in the watercourse. It should be noted however that the location of the proposed pier is currently a dry raised area in low flow conditions. Constructing the pier in this location will limit the impact on the riverbed and watercourse.

Sections of the existing bridge's northern parapet wall will have to be removed to create access to the new independent pedestrian bridge.

4.2.3 Independent Footbridge Risks

The risk associated with an independent footbridge is considerably less than the construction of a cantilever walkway as there is no work required to the existing bridge. In all cases site activities are minimised as the majority of the deck superstructure will be fabricated off site in factory conditions, which only leaves foundations and abutments/piers to be constructed on-site.

In the case of the glulam options, there is little experience of design, fabrication and construction of glulam bridges in Ireland and fewer suppliers in the market to design and supply the bridge. This could lead to cost

increases above pre-tender estimated costs. The reduced design life of timber compared to steel options also presents a risk to the maintenance of the structure in the longer term.

There is little other risk associated with the independent footbridge option compared to the cantilever option as it will have minimal impact on the existing bridge, utilities and road traffic etc. The risks associated with working in the watercourse for the two-span options can be mitigated through bunding and undertaking works during the summer period when river flows are reduced and impacts on aquatic life is minimised.

4.2.4 Technical Issues

Options 2 and 5 (the single span options), and Options 3 and 4 (the two-span options) are very similar from a technical perspective and it is likely that aesthetics, dynamics or the unconventional nature and/or reduced design life of glulam will dictate the preferred option between these. However, there are a few subtle differences as detailed in the paragraphs below.

The benefit of providing an intermediate support and a two-span structure is simply to achieve a thinner deck, balancing the presence of the pier against the slenderness in deck gained from the shorter spans. The steel structure will provide a significantly thinner section than timber, but the overall form will be quite similar. As discussed above, placing a pier in the river can have a negative impact from an environmental perspective. This can be mitigated by placing bunding and electro-fishing to create a dry working platform that is linked to the eastern abutment working area, minimising the impact.

The benefit of a single span is to limit the visual impact on the existing masonry bridge by providing a structure that retains as much of the existing view of the bridge as possible. However due to the long span there is a deeper deck when compared to a two span option which is more slender. Single span options are more complex in terms of dynamics and require significant inertial stiffness (and therefore structural depth) to satisfy dynamic requirements. With a span of approximately 46m, the depth required could be considered to impact on the aesthetics of the existing bridge, negating the benefit of using a single span.

It should also be noted that all options require the eastern abutment to be constructed on a raised bank to the side of the river. This bank is located between the fifth arch of the existing bridge, which returns around the corner and the arches of the adjacent tributary bridge. The bank is effectively an island formed by the main river channel and the tributary channel. All options will require access across the tributary channel, excavation and piling for the eastern abutment. This means that all options can be regarded as having in-stream works for the purposes of environmental impact assessment. All options will require extensive bunding, water and environmental management to be put in place in any case. Extension of this bunded perimeter to include the other dry bank where the intermediate pier is proposed for the two span options is entirely feasible and will not cause a significantly higher environmental impact than the single span options.

Option 2 – Single Span Steel Box Girder Footbridge

A single span structure will have significant structural depth due to the large clear span (46m) required. It should be noted that the governing criterion for the design of long span footbridges is typically the response of the bridge to vibrations induced by pedestrian footfall rather than the weight of the pedestrians. This means that while it is theoretically possible to make the bridge extremely slender in appearance, it will result in a bridge that is subject to excessive movement and vibrations to the point where it is uncomfortable for use by pedestrians.

Option 3 – Two Span Glulam Beam Footbridge

Option 3 has the advantage of a thinner cross section than a single span option due to the intermediate support. However, it should be noted that glulam cannot be guaranteed to meet the requirements of the brief for a 120 year design life. A Departure from Standards would be required for a reduced design life and TII have indicated that such a Departure is likely to be looked upon favourably in this instance. It is likely that a minimum design life of 60 years will be sought. Although there are many surviving examples of 100 year-old plus timber buildings, roofs and structures such as railway canopies, such structures have probably lasted because they have been maintained dry and with sealed roofing. There are few examples of surviving glulam bridge structures to provide proof of the durability of exposed timber structures.

In addition, the detailing of a glulam structure presents significant challenges to ensure that there are no latent durability issues present in the structure that may result in the structure not meeting the prescribed design life. Given that it would be one of the first major glulam footbridges constructed by TII, it would likely require a Principal inspection every 12 months to assess how it is performing and monitor any deterioration.

Option 4 – Two Span Steel Box Girder Footbridge

A two-span steel box girder footbridge will have the thinnest cross section of the four independent bridge options and while the dynamic response of the bridge will still be the governing design criterion, given that the span is reduced significantly due to the intermediate support it is not as critical an issue.

The flexibility of steel fabrication, combined with the intermediate pier allows for a curve to be introduced into the horizontal alignment of this option, which adds to the visual appeal from the top side and improves the user experience.

Option 5 – Single Span Steel Truss/Glulam Deck Footbridge

The structural form of Option 5 presents both the dynamic response issues associated with Option 2 and the durability issues of Option 3. Neither of these options are insurmountable particularly the durability issues as TII have indicated they would look favourably on a departure for the design life.

The overall structural depth of this option means the soffit of the bridge is lower than the soffit of the western arch of the existing bridge. In order to provide a slender structure with good aesthetic merit, it is likely that the bridge will be subject to movements and vibrations very close to the allowable limits which may present a structure that is considered uncomfortable to use.

5 AESTHETIC EVALUATION

The existing Castlecomer Footbridge is a substantial structure and a sense of solidity and mass underpin the aesthetic characteristics of the bridge. The sense of solidity is common to masonry arch structures as the flow of forces through the structure is predominantly vertical and there is no sense of any horizontal forces present. In addition, the structure has significant architectural merit and heritage value as detailed earlier in the report.

Given the presence of the existing structure and the proximity of the new structure, a “landmark” structure is considered inappropriate as previously noted in Section 3.1. Therefore, solutions which present as having a vertical sense to them and which do not present structure above or significantly below deck level have been preferred in developing the options described in the following paragraphs.

The five options are in steel or in timber. Contrasting steel or timber against the masonry of the existing bridge has some benefit in giving the footbridge its own identity, whilst maintaining an unfussy approach to the detailing allows the old bridge to maintain its presence.

Option 1 – Cantilever Structure

Architecturally, the merit of this option lies in the small structural sections necessary for the short spans between struts, which gives rise to a slender appearance of the new cantilever structure. With a light parapet largely using tensioned stainless steel wires and steel posts, the overall effect will result in a relatively discrete intervention in so far as practical.

However, there is clearly a significant impact on the existing structure in forming anchorages for the struts on the cutwaters and fixings for the deck at approximately string course level. The structure will also “blind” the niches above the cutwaters. It will no longer be possible to see the overall facade of the existing bridge in the way that was intended.

Access to the south facade of the bridge is difficult and this option cannot therefore provide an alternative viewpoint to see and understand the original composition. In contrast to the other options presented here, the walkway itself would not provide any new views of the existing bridge save for a new and very oblique view from the west end and does not therefore provide any mitigation of the visual obstruction.

Option 2 – Single Span Steel Box Girder Footbridge

This option leaves the original road bridge unaffected and will provide a close up view of the whole facade as well as oblique views from each end of the new work. The single span on a straight alignment provides a direct walking route in place of the footway on the road bridge.

As with all the option proposals, the view of the existing bridge from Castlecomer Discovery Park will be affected but the span length can be accomplished in steel and much of the facade will still be visible under the new work. The simplicity possible with a steel structure is appropriate at Castlecomer where there is no ambition to provide a landmark structure but rather to provide a well-engineered and architecturally minimal form which does not vie for attention with its dignified Palladian neighbour.

Option 3 – Two Span Glulam Beam Footbridge

Whilst a glue laminated structure would be appropriate in this environment – particularly the association of timber with footbridges – even dividing the 45m overall length into two spans still produces a depth of structural section which presents as quite heavy when viewed against the backdrop of the existing bridge.

The difficulties of fabricating a timber structure which is curved in two planes (and possibly tapered as well) makes a straight alignment desirable using timber technology and therefore the benefit of introducing a pier, which might allow a curved alignment, is lost although the structural section depth is reduced from what would be an extremely heavy section for a single span arrangement. Nevertheless, it is worth presenting here as an illustration of what could be achieved if a wholly timber solution were adopted.

Option 4 – Two Span Steel Box Girder Footbridge

Architecturally, the same comments apply here as to option 2 in terms of placing the footbridge away from the old bridge and looking for a relatively simple solution. Clearly, the benefit of dividing the span into two is to achieve a thinner deck, balancing the presence of the pier against the lightness in deck gained from the shorter spans.

The plan alignment of this option is a reverse curve which reduces the “canyon” effect between parapets on straight, narrow footbridges of this sort of length of crossing. The deck is proposed to be timber, which is laid along the length of the bridge and carried on transverse steel cantilever brackets. The deck boards are gapped allowing drainage through the surface and the steel spine beam is pentagon shaped to shed rainwater. The pentagon shaped spine also reduces the apparent depth of steel section and produces a layered effect of boards on brackets on top of the spine beam.

Of the solutions presented here, the two-span arrangement has clear advantages in terms of lightness of the structure and the ability to develop a curve in plan which is sympathetic to the original bridge alignment and mitigates perspective narrowing of the footway over the approximately 45m length of crossing.

Option 5 – Single Span Steel Truss/Glulam Deck Footbridge

In researching ways to allow a wholly timber structure to cross 45m in a single span, it becomes apparent that for instance, a glulam beam type bridge cannot make the distance without some augmentation unless an unfeasibly deep deck section was contemplated. In consequence, for this footbridge option, a relatively thin glulam deck plate forms the top chord of a truss structure which is about 1550mm deep overall.

This footbridge would present as distinctly different structurally to the existing bridge (and distinctly different to the other options considered here). The overall effect would be quite slight when seen against a mid-tone background, particularly with the steel elements painted a dark colour. Whilst this footbridge would have more presence in this environment and show a greater contrast in form and materials to the old bridge when compared with the other options, it would also present as quite a “fussy” solution.

Furthermore, the steelwork beneath the deck could be vulnerable to collecting debris or suffering impact damage in flood conditions. The structural lightness, which is the main merit of the bridge, would be lost if these sections were made more robust.

6 EVALUATION

A summary of the maintenance considerations for each option is outlined below in Table 6-1.

Table 6-1: Maintenance Considerations

Option	Maintenance Considerations
Option 1 – Cantilever Structure	Cantilever option will require nominal maintenance over the first 20 years after which maintenance painting of the steel work will be required. It is expected that full repainting will be required after 25-30 years. Other elements such as lighting, and deck surfacing will need maintenance and replacement after 20 years. No bearings or major movement joints required.
Option 2 - Single Span Steel Box Girder	The structure will require nominal maintenance over the first 20 years after which maintenance painting of the steel work will be required. It is expected that full repainting will be required after 25-30 years. Other elements such as lighting, and deck surfacing will need maintenance and replacement after 20 years. Bridge bearings and movement joints will need to be inspected and maintained regularly and replaced after 50 and 20 years respectively.
Option 3 - Two Span Glulam Beam	The structure will require nominal maintenance over the first 10-15 years after which full re-coating will be required. Other elements such as lighting, and deck surfacing will need maintenance and replacement after 20 years. Bridge bearings and movement joints will need to be inspected and maintained regularly and replaced after 50 and 20 years respectively.
Option 4 – Two Span Steel Box Girder	The structure will require nominal maintenance over the first 20 years after which maintenance painting of the steel work will be required. It is expected that full repainting will be required after 25-30 years. Other elements such as lighting, and timber decking will need maintenance and replacement after 20-25 years. Bridge bearings and movement joints will need to be inspected and maintained regularly and replaced after 50 and 20 years respectively.
Option 5 – Two Span Steel Truss/Glulam Deck	The structure will require nominal maintenance over the first 10-15 years after which full re-coating will be required. The steel elements of the structure will require nominal maintenance over the first 20 years after which maintenance painting of the steel work will be required. It is expected that full repainting will be required after 25-30 years. Other elements such as lighting, and deck surfacing will need maintenance and replacement after 20 years. Bridge bearings and movement joints will need to be inspected and maintained regularly and replaced after 50 and 20 years respectively.

7 HYDRAULIC CONSIDERATIONS

The existing bridge and weir are the primary hydraulic constraints in the river channel. As the proposed structure will be located immediately upstream of the existing bridge it will introduce an additional hydraulic constraint into the channel. A new bridge is required to have a hydraulic capacity comparable to the existing structure as a minimum. All options have been developed with this as a governing criterion using the guidance provided by the OPW[4].

As noted in Section 2.3.6, the 1:100-year flood level (1% AEP) is 113.36m which represents a flood level roughly at the springing point of the existing arches. Consequently, it is unlikely that the OPW will refuse approval of the Section 50 application for the new bridge on flooding grounds. Floodmaps.ie does not record any flood events in the area of the existing bridge at Castlecomer.

However, it is possible that OPW could refuse permission for the development on maintenance grounds where there is potential for debris to get caught in the structure. Figure 7-1 below shows the type of debris that could impact or get lodged in the structure, this photograph was taken in December 2018 and shows a large tree trunk lodged on the weir.

Figure 7-1: Debris located at the Weir from a Flood Event in December 2018

As seen in Figure 7-1, the weir crosses the watercourse at an angle to the river such that it runs in a southwest/northeast direction from the riverbank adjoining the Discovery Park to the first western pier of the existing bridge. The majority of the water flow is consequently directed through the western most span of the existing bridge, particularly in lower flow times. As a result, maintaining the flood level and minimum free board in this span is considered critical to avoiding maintenance issues where debris could become lodged in this span.

[4] Construction, Replacement or Alteration of Bridges and Culverts - A Guide to Applying for Consent under Section 50 of the EU(Assessment and Management of Flood Risks) Regulations SI 122 of 2010 and Section 50 of The Arterial Drainage Act, 1945 available from https://www.opw.ie/media/Section%2050%20Brochure.pdf

A summary of the issues for each option is outlined below:

Option 1 – There is potential for floating debris in particular tree trunks to cause damage to and get lodged in the struts supporting the cantilever and cause major structural damage to the walkway.

Option 2 – There is potential for debris to impact the deck structure. As a solid single member, the bridge superstructure is more robust than the slender members presented in other options and impact should not cause major structural damage.

Option 3 – There is potential for debris to impact the deck structure and the pier. Similar to Option 2 the deck is a solid member and would be considered relatively robust and impact should not cause major structural damage. The pier will be designed to withstand impact from debris.

Option 4 – There is potential for debris to impact the deck structure and the pier. Whilst the deck is relatively slender, it is also reasonably robust, and impact should not cause major structural damage to the spine beam. The pier will be designed to withstand impact from debris. This option also presents more favourably with the highest soffit levels over the western arch of the existing bridge due to the minimal structural depth when compared to all other bridge options.

Option 5 – There is potential for debris to impact the deck structure. This is a particular issue for this option due to the open and slender nature of the deck truss members which could cause major structural damage to the bridge. There is also the potential for debris to be lodged between the structural members. It is also noted that the clearance of this option above the flood level in the western most span of the existing bridge is less than all the other options presented and therefore higher risk.

It is likely that Options 1 & 5 will be looked upon unfavourably by OPW when compared with the other three options due to potential maintenance issues and may not be considered good practice in the context of their guidelines.

8 HEALTH & SAFETY CONSIDERATIONS

8.1 Traffic Management During Construction

All of the options will require some form of traffic management during the works period in accordance with Chapter 8 of the Traffic Signs Manual. Short duration road closures may also be required for periods of time subject to the contractor's chosen construction methodology.

Option 1 requires considerable works to the existing bridge. Therefore, as a minimum, a lane closure will be required for a considerable period. Indeed, it is quite likely that full road closures will be necessary for short durations to facilitate reconstruction of the deck surface and road pavement for this option.

8.2 Safety During Construction

Option 1 may require in-stream works depending on the chosen struts and the angle at which they are placed. However, it is likely to be limited to the provision of access platforms.

Options 2, 3, 4 & 5 require in-stream works which brings considerable risks during construction, although they can be readily mitigated through best practice. It should be noted that while these options require in-stream works and erection of large precast elements, a significant portion of the construction has been transferred off site and will be conducted under factory conditions.

All options require piled foundations, which limits the size of excavations needed for foundations. Piling operations and construction of pile caps will be constructed at existing ground level.

In addition to the general obligations and duties under the Safety, Health and Welfare at Work Act 2005, RPS will undertake the duties of Project Supervisor Design Process (PSDP) and prepare a Preliminary Safety & Health Plan for the works. The works will also be designed taking account of the principles of prevention.

It is envisaged that the appointed contractor will be experienced in bridge construction and will be appointed Project Supervisor Construction Stage (PSCS) for the duration of the works.

8.3 Safety in Use

All steel deck options will have a combined waterproofing and non-slip surfacing applied to ensure the safety of users. Options with a timber deck will ensure that the deck surface has a suitable non-slip finish that meets the requirements of Clause 10.3 of DN-STR-03005, *Design Criteria for Footbridges*. This would likely be achieved through the addition of gritted resin strips on the timber deck boards.

All options are currently shown with 1.25m high pedestrian parapets that use horizontal tensioned wires to minimise the visual impact and increase transparency. These systems have been widely used and climbing can be prevented by providing an inward incline on the parapet posts.

Inspection of the bridge superstructure can be undertaken safely from the bridge itself and from the river during low flow times accessed from the adjacent Discovery Park. Inspection of abutments and bearings can be undertaken from ground level and appropriate access for inspection will be provided in the design. Close up inspection of the bearings over the intermediate pier for Options 3 &4 will be possible during the low flow summer months.

The likely significant maintenance operations required during the life span of the bridge will vary depending on the chosen option. These are summarised in Section 6. Each of these maintenance operations is common place in the industry and management of the related health and safety issues is well understood.

9 CONSTRUCTION AND BUILDABILITY

All of the options considered are readily constructible by a contractor experienced in bridge construction. No issues have been identified that would not be inherent in comparable bridge schemes completed elsewhere in Ireland. The possible exception to the above is Options 3 & 5 (glulam bridges) which require specialist design, manufacture and construction, although it is noted that a small number of these types of bridges have been successfully commissioned in Ireland.

9.1 Option 1 – Cantilever

The cantilever will need substantial support from the existing bridge in the form of a buried anchorage or tie bar to support the main deck. This will involve some demolition of the existing spandrel wall and excavation of the carriageway between the arches to construct the anchorages. This will be difficult to achieve whilst maintaining live traffic on the bridge. It may also have an impact on utilities buried under the road/footpath on the bridge.

This option involves at least some demolition and modification to the existing stone arch bridge. Whilst this has been done many times on other similar projects, there is always an element of uncertainty associated with an old stone bridge.

9.2 Options 2-5 – Independent Footbridge

The independent footbridge will require in-stream works to be constructed. In-stream works of this nature have been undertaken on multiple occasions in Ireland and are not considered a particular impediment, although seasonal constraints apply to the programming of such works.

It should also be noted that all options require the eastern abutment to be constructed on a raised bank to the side of the river. This bank is located between the fifth arch of the existing bridge, which returns around the corner and the arches of the adjacent tributary bridge. The bank is effectively an island formed by the main river channel and the tributary channel. All options will require access across the tributary channel, excavation and piling for the eastern abutment. This means that all options can be regarded as being in-stream for the purposes of environmental impact assessment.

All options will require extensive bunding, water and environmental management to be put in place in any case. Extension of this bunded perimeter to include the other dry bank where the intermediate pier is proposed for the two span options is entirely feasible and will not cause a significantly higher environmental impact than the single span options.

The independent footbridge can also be constructed with minimal impact on the existing bridge, utilities or road traffic.

It is likely that an independent footbridge of this size would be fabricated off site and transported to site fully assembled, although it is possibly at the limit of how this could be achieved economically. An overnight full closure of the N78 would be required to set up a crane on the N78 and the fully assembled bridge would be lifted into position in a single operation.

Should it not be possible to transport the bridge in one piece, the single span options could be fabricated in two or three components and assembled in a worksite in the field to the southwest of the bridge site, where a compound is likely to be located for the works. It should be possible to locate a suitable crane in this field to lift the fully assembled bridge into place in a single lift.

This has advantages over the other options in terms of health & safety and quality of workmanship with only the foundations and abutments needing on-site works

The two span options could also be designed to be lifted into position fully assembled, but the slenderness of the sections may lend themselves more to fabrication and erection in three sections. In this instance, on-site splicing of the sections would be required in-situ with temporary supports located in the river.

9.3 Summary

The independent footbridge is clearly the most favourable option in terms of buildability. They have a significantly lower impact on the existing bridge and the traffic on the N78. Most of the fabrication work will be done off-site in factory conditions.

The timber glulam options rely on a smaller pool of specialist suppliers and contractors experienced with the material, so there are disadvantages associated with these options.

The single span steel option is probably the easiest to construct, with no intermediate pier and erection in one piece. With some careful design and planning, it should also be possible to erect the curved two-span steel option fully assembled.

10 GROUND CONDITIONS

10.1 Option 1 – Cantilever

The cantilever will need substantial support from the existing bridge in the form of a buried anchorage or tie bar to support the main deck and consequently structural investigations of the existing bridge are required to identify constraints. However, based on previous experience the outcome of the investigations will not materially change the methodology or structural form of the anchorages through which the cantilever would be supported.

10.2 Independent Footbridge Options 2-5

Preliminary ground investigations indicated that all options will require piled foundations to be constructed. Bed rock is estimated be approximately 15-20m below existing ground level.

It is not envisaged at this time that further detailed ground investigation will materially alter the proposed type of bridge foundation.

11 CONSULTATION WITH RELEVANT AUTHORITIES

There are a significant number of stakeholders in the scheme as outlined in section 2.3.4. To date, informal consultations have been held with a number of authorities and private landowners.

The scheme will require planning permission in accordance with the Planning and Development Act 2010. An application will be made to An Bord Pleanala under Section 177AE of the Act in due course. This process includes a statutory consultation process with prescribed bodies, which will act as the primary medium for formal consultation with the majority of the relevant authorities. The remainder will be consulted with during preliminary design stage.

12 ECONOMIC EVALUATION

12.1 Construction Costs

constructed elsewhere in Ireland. Details of the cost estimate are outlined below in Table 12-1. Further details are given in Appendix C.

In considering the economic evaluation of the proposed options, it is also prudent to consider the out-turn cost certainty. In the context of the risks outlined in Section 4.0, a new independent footbridge has the highest cost certainty as it has fewer potential risks. In particular, the risks that arise when undertaking works to the existing structure as necessitated by Option 1 pose significant financial risk.

Options 2 has the highest cost certainty, due to the conventional nature of the structure. Option 4 has a high level of cost certainty, but the curved profile, an additional pier and a proposed timber deck introduce some risk factors that Option 2 does not have.

Options 3 & 5 have low cost certainty due to the specialist nature of the glulam material and the lack of experienced suppliers in Ireland.

Table 12-1: Options Construction Cost Estimate

Option	Estimated Cost Ex. Vat	Out-turn Cost Certainty
Option 1 – Cantilever Structure	€636k	Low
Option 2 – Single Span Steel Box Girder	€1,086k	High
Option 3 – Two Span Glulam	€1,226K	Low
Option 4 – Two Span Steel Box Girder	€902k	High
Option 5 – Single Span Steel Truss/ Glulam Deck	€1,191k	Low

It should be noted that the above cost estimates are construction costs only, and do not include other scheme costs such as design, supervision, land acquisition, client costs etc.

12.2 Whole Life Costs

The whole life cost of Option 1 is probably the most favourable, given that it does not have bearings, joints and timber components that require maintenance and repair over the design life of the structure. It does have structural steelwork that will require periodic maintenance painting and deck surfacing that will need replacement over the structure's 120 year design life.

Option 2 is the next most favourable. As per Option 1, it has structural steelwork that will require periodic maintenance painting and deck surfacing that will need replacement over the structure's 120 year design life. It also has bearings and joints at the abutments that need maintenance and replacement.

Option 4 is similar to Option 2, except it has an additional bearing at the intermediate pier, and a timber deck that will require maintenance and replacement over the structure's 120 year design life.

Options 3 & 5 have a high Whole Life Cost when considered over a comparable design life of 120 years. The glulam elements will have a design life of 50/60 years, so these options are likely to require full replacement at that stage. Option 5 has a steel sub-frame which could be designed to remain in place with some temporary propping whilst the glulam deck is replaced. This however is unlikely to be economically viable and removal off-site for replacement of the glulam deck is likely to be needed.

13 ENVIRONMENTAL EVALUATION

As the location of the proposed development is within a SAC in an environmentally sensitive watercourse, there is potential for adverse environmental impacts with all options. However, all of these impacts can be mitigated with appropriate standard mitigation measures that are undertaken as part of construction best practice. It should also be noted that in-stream works will be undertaken during the summer period outside the fisheries window and during periods of low river flow.

There is a stand of Japanese Knotweed on the area of scrub land on the east bank of the river, near to the proposed location of the eastern abutment. To avoid the Knotweed, best practice would be to provide a 7m exclusion for all plant and machinery. However, due to the constrained nature of the site it is not considered reasonably practical to achieve a 7m exclusion zone. To achieve this, the eastern landing of the bridge would need to be moved considerably further north which would have a significant effect on increasing the scale, nature and impact of the scheme within the SAC.

It is proposed to physically remove the Japanese Knotweed and deal with it in accordance with best practice guidelines through an Invasive Alien Species Management Plan which has been developed as part of the scheme.

Option 1 – Cantilever

This option has less potential ecological impacts as the in-stream works would be limited to the provision of an access scaffold and platforms, all other works would be undertaken within the envelope of the access platform and the existing bridge. Consequently, there is limited potential for adverse environmental impact as the superstructure will be largely prefabricated offsite and assembled on site.

This option has considerable negative impact on the cultural heritage of the existing bridge as discussed in Section 2.2.2. Given it is a protected structure; this option is not favoured from a built heritage conservation perspective.

Options 2 - 5 – Independent Footbridges

As discussed in earlier chapters the location of the proposed bridge has been dictated by the pedestrian desire line and is constrained by a number of criteria. It should be noted that all options require the eastern abutment to be constructed on a raised bank to the side of the river. This bank is located between the fifth arch of the existing bridge, which returns around the corner and the arches of the adjacent tributary bridge. The bank is formed between the main river channel and the tributary channel. All options will require access across the tributary channel, excavation and piling for the eastern abutment. This means that all options can be regarded as being in-stream for the purposes of quantifying the environmental impact. This is particularly relevant in the context of the proposed Japanese Knotweed removal which is located immediately adjacent to the riverbank. The area disturbed by the Knotweed removal shall be reinstated similar to the existing conditions.

To facilitate safe construction and undertake best environmental management practices, the construction of the eastern bridge foundations will require extensive bunding, water and environmental management. To access the location of the eastern abutment, plant and labour will need to cross the tributary channel of the Dinin.

The extent of the bunded perimeter will likely extend from the tributary bridge to the middle of existing Castlecomer bridge which includes the footprint of the proposed intermediate pier of the two-span options. Consequently, there is negligible difference in the potential construction stage environmental impacts of all the bridge options.

For the two-span bridges, it could be considered that there is a nominal loss of habitat due to the presence of the pier in the river. However, the loss of habitat area will be less than 1m^2 which is negligible when considered against the channel reach and available habitat within the SAC and could be offset with habitat to be reinstated following the removal of Japanese Knotweed.

When compared to Option 1, the independent bridges have significantly less impact on the existing bridge. They do not materially alter the existing structure although there is an impact on the wall adjoining the bridge on the west bank of the river. This impact is considerably less than the provision of a new steel cantilever structure all along the elevation of the existing bridge. It should also be noted that an independent bridge allows the general public to view the existing bridge and its unique features from a different perspective.

Summary

Based on the considerations above, it is clear that Option 1 (cantilever) has a detrimental impact from a cultural heritage perspective when compared to the independent bridge options. All of the independent bridge options have similar considerations for potential environmental impacts given the constrained site, works required and presence of Japanese Knotweed.

14 OVERALL EVALUATION OF PROPOSED OPTIONS

14.1 Evaluations of Options

The five options for the type of crossing were assessed under various headings as set out below in Table 14-1 and as discussed in previous sections of this report. The options were ranked 1-5 against each criterion in terms of preference, with 1 being the most desirable option for that criterion and 5 being the least desirable option for that criterion.

Table 14-1: Engineering Assessment Matrix

Criterion	Description	Ranking - 1 - Most Desirable (Least Impact)	2	3	4	Ranking - 5 – Least Desirable (Greatest Impact)
1	Geometry & Alignment	Option 4	Option 3	Option 2	Option 5	Option 1
2	Aesthetics and Visual Impact * (note subjective)	Option 4	Option 3	Option 5	Option 2	Option 1
3	In Service Functionality (Pedestrian Comfort)	Option 1	Option 4	Option 3	Option 2	Option 5
4	Structural Efficiency	Option 4	Option 3	Option 1	Option 5	Option 2
5	Hydraulics/Flooding Impact	Option 2	Option 4	Option 3	Option 1	Option 5
6	Foundation Requirements	Option 5	Option 2	Option 3	Option 4	Option 1
7	Construction & Buildability	Option 2	Option 4	Option 5	Option 3	Option 1
8	Maintenance Requirements	Option 1	Option 2	Option 4	Option 5	Option 3
9	Environmental Impact	Option 1	Option 2	Option 5	Option 4	Option 3
10	Construction Health and Safety	Option 2	Option 5	Option 4	Option 3	Option 1
11	Capital Cost	Option 1	Option 4	Option 2	Option 5	Option 3
12	Whole Life Cost (Durability)	Option 1	Option 2	Option 4	Option 5	Option 3
13	Risk	Option 4	Option 2	Option 5	Option 3	Option 1
14	Ease of Fabrication and Transport	Option 1	Option 4	Option 2	Option 5	Option 3
15	Vulnerability to Vandalism	Option 4	Option 2	Option 1	Option 5	Option 3

The scores for each option were added and the option with the lowest overall score means it is the most desirable option when assessed against the criteria listed in Table 14-1 above. The minimum possible score is 15 and the maximum possible score is 75. The results are shown in Table 14-2 below. It should be noted that the criteria have not been weighted, and if the scores were close between a number of options, consideration should be given to weighting some of the more important criteria.

Table 14-2: Engineering Assessment Results – Options

Option	Score	Ranking
1	46	3
2	37	2
3	57	5
4	32	1
5	53	4

15 CONCLUSION AND RECOMMENDATION

15.1 Conclusion

It is clear from the preceding chapters there are a significant number of competing constraints that need to be carefully balanced in order to ensure that the optimum solution is proposed. The purpose of the scheme as outlined in Chapter 1 is to provide new pedestrian facilities in Castlecomer across the River Dinin while improving overall road safety for both pedestrians and vehicular users.

In developing the preferred option, all of the constraints highlighted in Chapter 2 have been carefully considered and a number of feasible options were discussed at length with KCC, KNRO and TII. These options were developed into a shortlist of five options for evaluation in this Options Report. An assessment of the preferred option has been undertaken under a number of criteria. Based on the evaluation undertaken in Section 14, Option 4 is considered the preferred option as it most adequately addresses all of the constraints which can be simplified to the following points:

- The structure is considered safe & useable by pedestrians;
- It presents as the most desirable route for pedestrians to cross the river;
- The structure meets OPW hydraulic capacity requirements;
- The structure is cost effective with aesthetic merit;
- The development has no adverse impact on the SAC:
- The impact on the existing protected structure both physically and visually is minimised.

In addition to the points above, Option 4 also presents a number of advantages in terms of cost and construction certainty when compared to the other solutions as it is a well understood material with far more suppliers in the market with a track record of delivering steel structures than glulam timber. It does not bring with it the risk and uncertainty that would come with alterations to the existing structure required for Option 1.

15.2 Recommendation

The outcome of the options study indicates that a two-span steel box girder footbridge (Option 4) with a timber deck should be considered as the preferred option.

It is recommended that Option 4 is taken forward to planning stage as the preferred option.

16 DRAWINGS AND DOCUMENTS

16.1 RPS Bridge Options

The following Options drawings are included in Appendix A of this report.

Drg. No.	Rev.	Title
RPS Drawings		
MCT0759BR0101-00	P01	Index Sheet
MCT0759BR0101-01	P01	Proposed Option 1 – Steel Cantilever
MCT0759BR0101-02	P01	Proposed Option 2 – Single Span Steel Box Girder
MCT0759BR0101-03	P01	Proposed Option 3 – Two Span Glulam Beam
MCT0759BR0101-04	P01	Proposed Option 4 – Two Span Steel Box Girder
MCT0759BR0101-05	P01	Proposed Option 5 – Single Span Steel Truss/Glulam Deck

16.2 Documents

The Appendices to this Report are:

- Appendix A Bridge Options Drawings & Photomontages
- Appendix B Geotechnical Information
- Appendix C Cost Estimate
- Appendix D Cultural Heritage Assessment

Appendix A

Bridge Options Drawings & Photomontages

KILKENNY
COUNTY
COUNCIL

Eirspan Task Order No. 302 N78, Castlecomer Footbridge

December '18

OPTIONS DRAWINGS

DRAWINGS :-

BR0101-00	INDEX SHEET
BR0101-01	PROPOSED OPTION 1 - STEEL CANTILEVER
BR0101-02	PROPOSED OPTION 2 - SINGLE SPAN STEEL BOX
BR0101-03	PROPOSED OPTION 3 - TWO SPAN GLULAM / STEEL
BR0101-04	PROPOSED OPTION 4 - TWO SPAN STEEL
BR0101-05	PROPOSED OPTION 5 - SINGLE SPAN - GLULAM / STEEL

Client

KILKENNY
COUNTY
COUNCIL

General Notes

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Rev	Date	Dsn / Chk	Amendment / Issue	App
P01	Apr.'19	DC / EC	Issue For Planning	AO'B

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Model File Identifier: MCT0759BR0101

Scale: Shown @ A1, Half @ A3

Created on: Nov. 2018

Sheets: BR0101-00 of 6

Project: **Eirspan Task Order No. 302 N78, Castlecomer Footbridge**

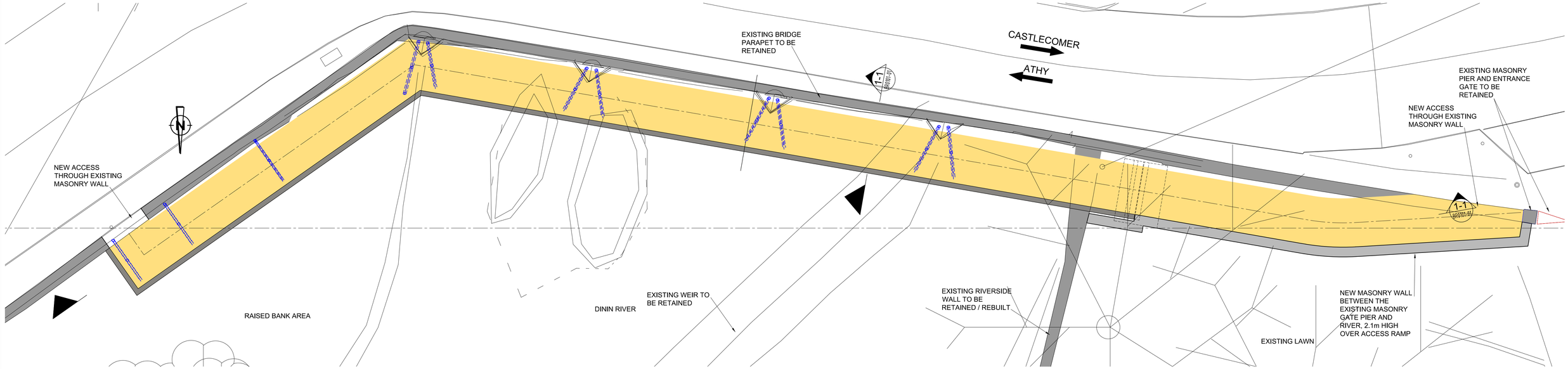
Title: INDEX SHEET

File Identifier: MCT0759BR0101 - BR0101-00

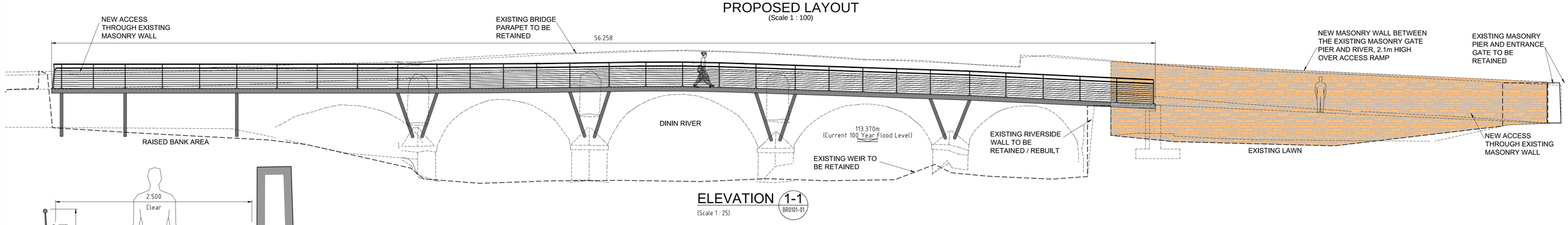
Status: S4

Rev: P01

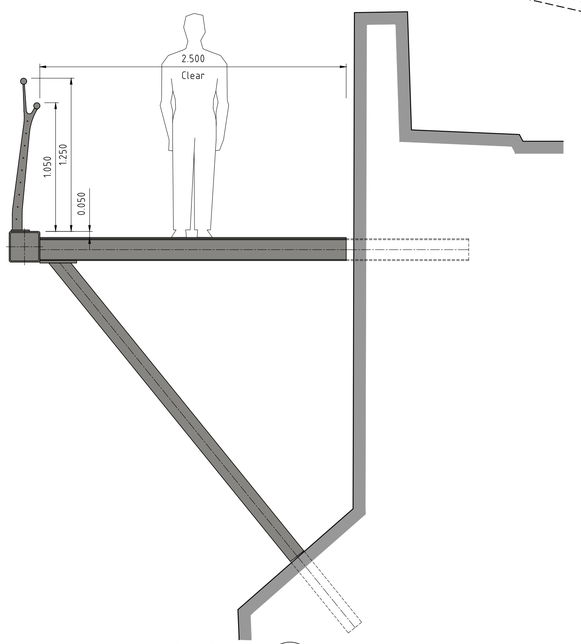
R:\MCT0759 - Eirspan TO302 N78 Castlecomer Footbridge\8.0 Drawings\Br\MCT0759BR0101.dwg



PROPOSED LAYOUT
(Scale 1 : 100)



ELEVATION 1-1
(Scale 1 : 25)



SECTION 1-2
(Scale 1 : 25)

PHOTOMONTAGE OPTION 1

POWELL-WILLIAMS ARCHITECTS
41 Gwendolen Avenue, London SW15 6EP UK
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mail@powell-williams.co.uk

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P01	Apr.'19	DJC EFC	Issue For Panning	AO'B
D01	Nov.'18	DJC EFC	Draft Issue For Discussion	AO'B

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Model File Identifier: MCT0759BR0101

Scale: Shown @ A1, Half @ A3

Created on: Nov. 2018

Sheets: BR0101-01 of 6

Project: **Eirspan Task Order No. 302**
N78, Castlecomer Footbridge

Title: PROPOSED OPTION 1
STEEL CANTILEVER

File Identifier: MCT0759BR0101 - BR0101-01

Status: S4

Rev: P01

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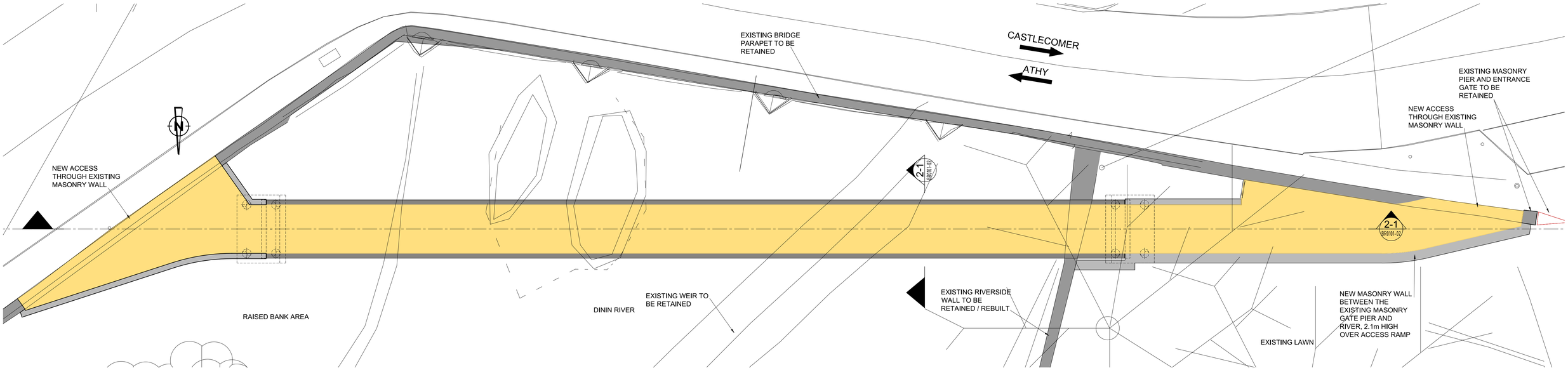

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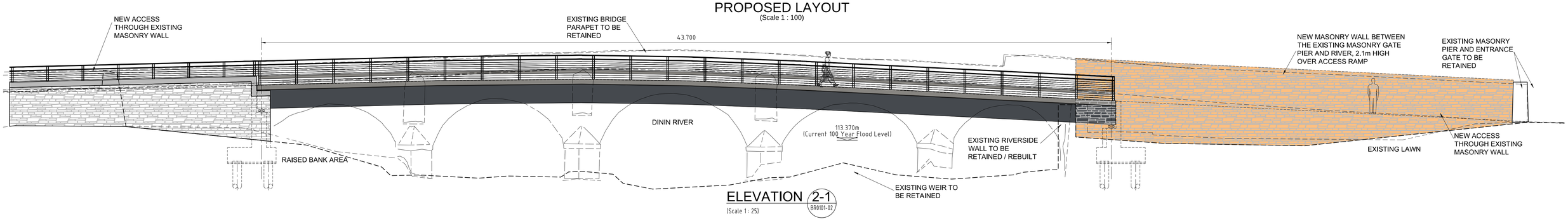
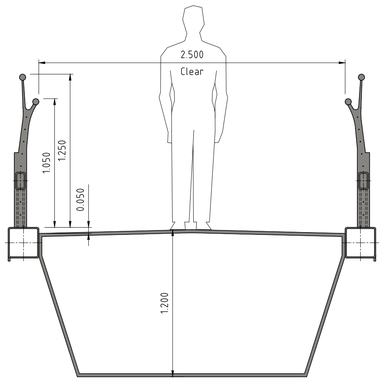
(Scale 1 : 100)



ELEVATION 2-1
(Scale 1 : 25)
BR0101-02



SECTION 2-2
(Scale 1 : 25)
BR0101-02

PHOTOMONTAGE OPTION 2

POWELL-WILLIAMS ARCHITECTS
41 Gwendolen Avenue, London SW15 6EP UK
+44 (0)20 8788 3957
mail@powell-williams.co.uk

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KILKENNY
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P01	Apr.'19	DC EC	Issue For Panning	AO'B
D01	Nov.'18	DC EC	Draft Issue For Discussion	AO'B

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Model File Identifier: MCT0759BR0101

Scale: Shown @ A1, Half @ A3

Created on: Nov. 2018

Sheets: BR0101-02 of 6

Project: **Eirspan Task Order No. 302**
N78, Castlecomer Footbridge

Title: PROPOSED OPTION 2
SINGLE SPAN STEEL BOX

File Identifier: MCT0759BR0101 - BR0101-02

Status: S4

Rev: P01

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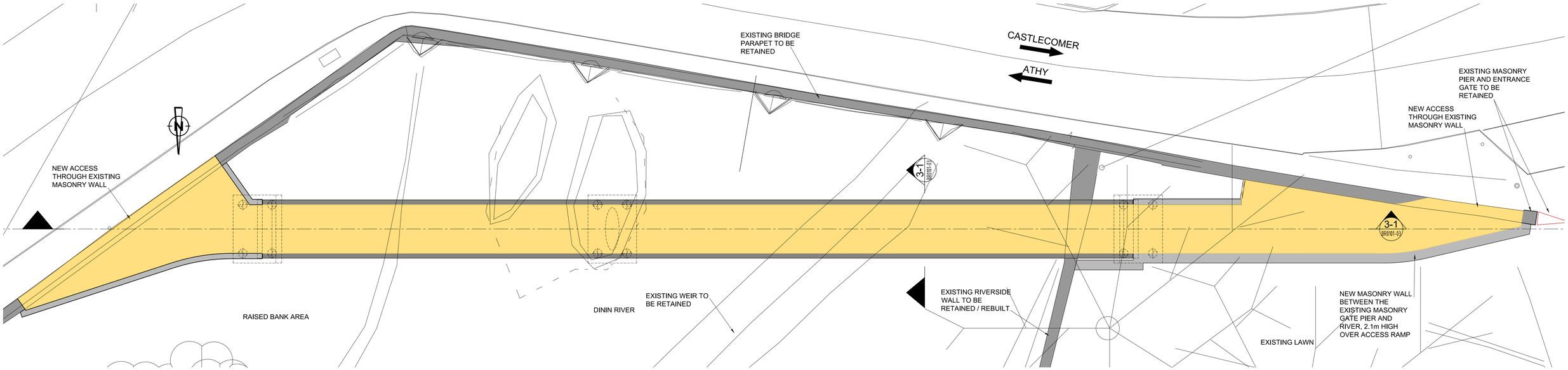

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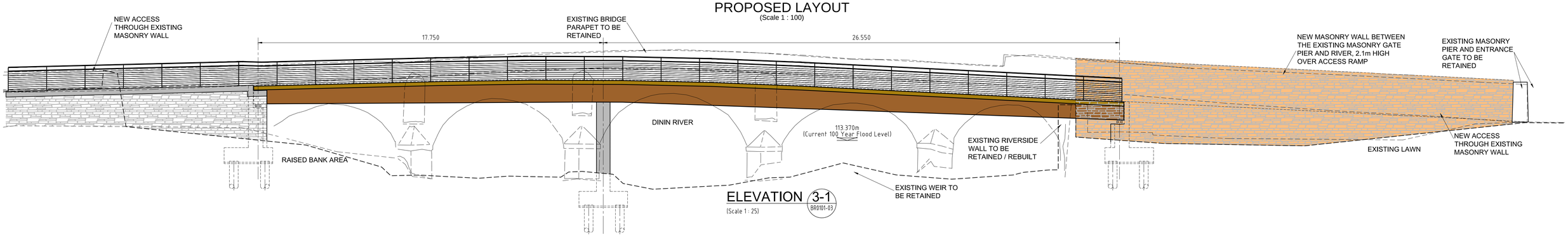
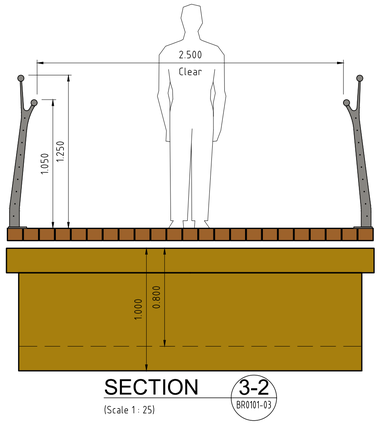


ELEVATION 3-1
(Scale 1 : 25) BR0101-03



SECTION 3-2
(Scale 1 : 25) BR0101-03

PHOTOMONTAGE OPTION 3

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+44 (0)20 8788 3957
mail@powell-williams.co.uk

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KILKENNY
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D01	Nov.'18	DC EC	Draft Issue For Discussion	AO'B

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Model File Identifier: MCT0759BR0101

Scale: Shown @ A1, Half @ A3

Created on: Nov. 2018

Sheets: BR0101-03 of 6

Project: **Eirspan Task Order No. 302**
N78, Castlecomer Footbridge

Title: PROPOSED OPTION 3
TWO SPAN GLULAM / STEEL

File Identifier: MCT0759BR0101 - BR0101-03

Status: S4

Rev: P01

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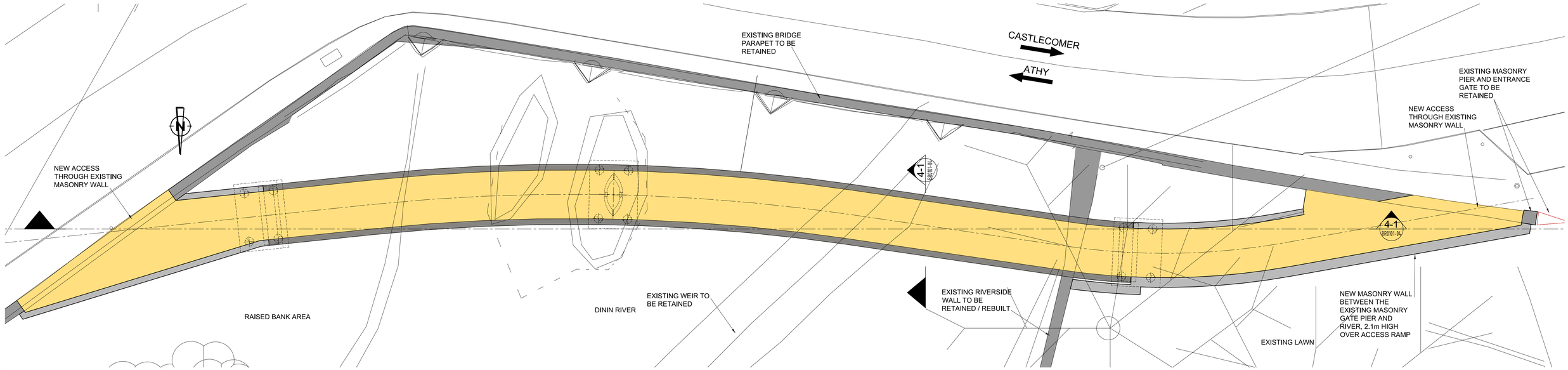

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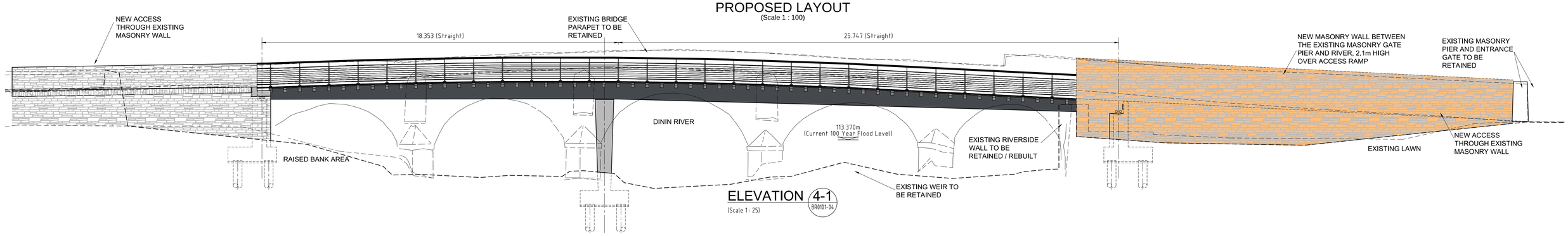
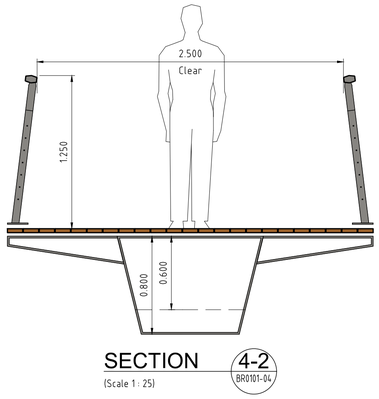
(Scale 1 : 100)



ELEVATION 4-1
(Scale 1 : 25)
BR0101-04



SECTION 4-2
(Scale 1 : 25)
BR0101-04

PHOTOMONTAGE OPTION 4-2

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Client

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D01	Nov.'18	DC EC	Draft Issue For Discussion	AO'B

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Model File Identifier: MCT0759BR0101

Scale: Shown @ A1, Half @ A3

Created on: Nov. 2018

Sheets: BR0101-04 of 6

Project: **Eirspan Task Order No. 302**
N78, Castlecomer Footbridge

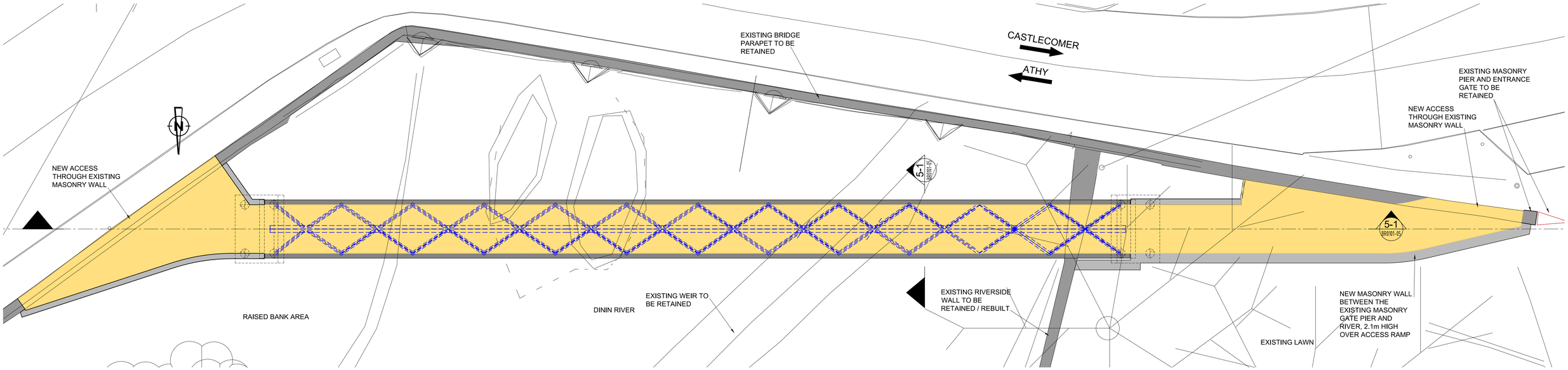
Title: PROPOSED OPTION 4
TWO SPAN STEEL

File Identifier: MCT0759BR0101 - BR0101-04

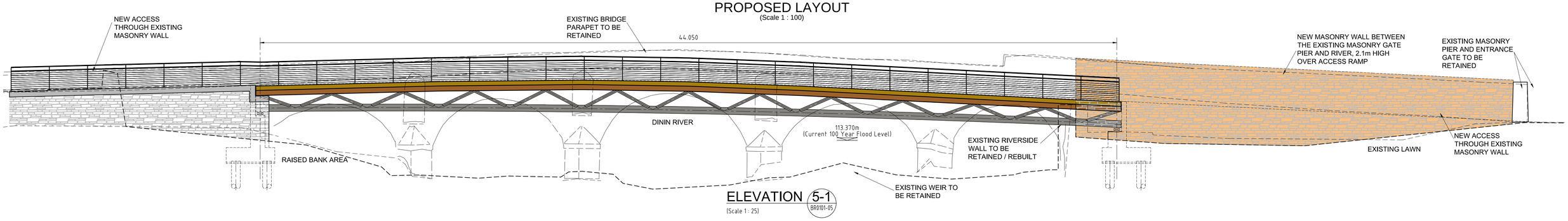
Status: S4

Rev: P01

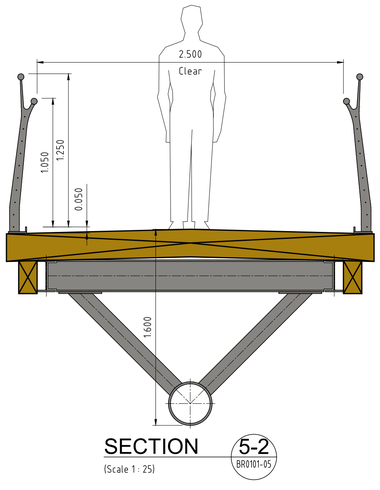
R:\MCT0759 - Eirspan TO302 N78 Castlecomer Footbridge\8.0 Drawings\Bri\MCT0759BR0101.dwg



PROPOSED LAYOUT
(Scale 1 : 100)



ELEVATION 5-1
BR0101-05
(Scale 1 : 25)



SECTION 5-2
BR0101-05
(Scale 1 : 25)

PHOTOMONTAGE OPTION 5

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+44 (0)20 8788 3957
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Client

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Transport Infrastructure Ireland

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Model File Identifier: MCT0759BR0101

Scale: Shown @ A1, Half @ A3

Created on: Nov. 2018

Sheets: BR0101-05 of 6

Project: **Eirspan Task Order No. 302**
N78, Castlecomer Footbridge

Title: PROPOSED OPTION 5
SINGLE SPAN - GLULAM / STEEL

File Identifier: MCT0759BR0101 - BR0101-05

Status: S4

Rev: P01

R:\MCT0759 - Eirspan TO302 N78 Castlecomer Footbridge\8.0 Drawings\Bim\MCT0759BR0101.dwg

Appendix B

Geotechnical Information

Our Ref: JMS/Rp/P18243 + attachments (*.pdf)

23rd November, 2018

Messrs. RPS
County Hall,
John Street,
Kilkenny,
Ireland,
R95 139T.

Re: Castlecomer– Site Investigation, Factual report.

Introduction

In October 2018, Priority Geotechnical were requested by Kilkenny County Council acting on behalf on behalf of their client, Transport Infrastructure Ireland (TII), to undertake a site investigation on the N78 National Secondary Road, Castlecomer Co. Kilkenny. RPS were acting as consulting engineers for the project.

Scope

The scope of the ground investigation, which was specified by RPS, comprised of:

- 02Nr Rotary boreholes;
- Associated lab testing and
- Factual reporting.

The final site works as completed is outlined, herein**.**

This factual report presents the factual records with regard to the ground investigation and data obtained at the N78 Castlecomer, Co. Kilkenny. This report should be read in conjunction with the accompanying exploratory records and test data.

Site Works

This investigation was carried out in accordance with Eurocode 7- Geotechnical Design Part 2, ground investigation and testing (BS EN 1997-2: 2007) and the relevant British Standards (BS 5930 (2015) Code of Practice for Site Investigation and BS 1377, Method of Tests for Soil for Civil Engineering Purposes, *in situ* Tests Parts 1 to 9).

The fieldworks were undertaken on the 16th and 17th October, 2018 under the supervision of PGL, Engineering Geologist(s). Details of the plant and equipment used are detailed on the relevant exploratory records, attached herein.

Survey

The site is to be surveyed at a later date. The location sketch provided below should be used for reference only.

Rotary Boreholes

Two (2) rotary boreholes were advanced to depths 19.5m below existing ground level (bgl) to 20.4m bgl using PGL's Deltabase 520 rig and 131mm diameter casing. The exploratory logs are accompanying this factual report.

Location	Depth (m bgl)
RC01	19.5
RC02	20.4

In-Situ Testing

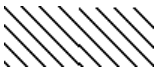
Standard Penetration Tests, N values, were typically carried out in the boreholes using the 60^{o} solid cone in place of the standard split barrel sampler. The Standard Penetration Test was carried out in accordance with Geotechnical Investigation and Testing, Part 3 Standard penetration test, BS EN ISO 22476-3:2005+A1:2011. Twenty two (22) standard penetration tests were carried out in the cable percussion boreholes with values ranging from Nspt= 4 to Nspt=>35. The data is presented on the exploratory logs accompanying this factual report.

Laboratory Testing

Rock testing was scheduled by RPS and carried out by PGL in accordance with the ISRM suggested methods for rock characterisation, testing and monitoring. The laboratory data accompanies this report and was summarised as follows;

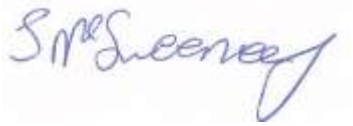
Type	Nr.	Remarks
Unconfined Compressive Strength (UCS)	01	45.45MPa
Point Load Is50	05	0.2MPa to 8.7MPa.

Exploratory boreholes were backfilled with bentonite upon completion of the works. Backfill details are shown below and presented graphically on the exploratory logs accompanying this factual report.

 BENTONITE Backfill to installation/ borehole

Should you have any queries in relation to the data collected, please do not hesitate to contact our office.

Yours sincerely,
For **Priority Geotechnical,**



James McSweeney BSc
Engineering Geologist

No responsibility can be held by PGL for ground conditions between exploratory locations. The exploratory logs provide for ground profiles and configuration of strata relevant to the investigation depths achieved during the fieldworks. Caution shall be taken when extrapolating between such exploratory locations. No liability is accepted for ground conditions extraneous to the exploratory locations.

No account has been taken of potential subsidence or ground movement due to mineral extraction, mining works or karstification below or in proximity to the site, unless specifically addressed.

This report has been prepared for Employer and their Representative as outline, herein. The information should not be used without their prior written permission. PGL accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.

KEY TO SYMBOLS ON EXPLORATORY HOLE RECORDS

All linear dimensions are in metres or millimetres

DESCRIPTIONS

**	Drillers Description
Friable	Easily crumbled

SAMPLES

U( )	Undisturbed 102mm diameter sample, ( ) denotes number of blows to drive sampler
U( )F, U( )P	F- not recovered, P-partially recovered
U38	Undisturbed 38mm diameter sample
P(F), (P)	Piston sample - disturbed
B	Bulk sample - disturbed
D	Jar Sample - disturbed
W	Water Sample
CBR	California Bearing Ratio mould sample
ES	Chemical Sample for Contamination Analysis
SPTLS	Standard Penetration Test S lump sample from split sampler

CORE RECOVERY AND ROCK QUALITY

TCR	Total Core Recovery (% of Core Run)
SCR	Solid Core Recovery (length of core having at least one full diameter as % of core run)
RQD	Rock Quality Designation (length of solid core greater than 100mm as % of core run)

Where there is insufficient space for the TCR, SCR and RQD, the results may be found in the remarks column

If	Fracture Spacing in mm (Minimum/Average/Maximum) NI - non intact, NR - no recovery
AZCL	Assumed Zone of Core Loss
NI	Non intact

GROUNDWATER

▽	Groundwater strike
▼	Groundwater level after standing period
Date/Water	Date of shift (day/month)/Depth to water at end of previous shift shown above the date and depth to water at beginning of shift given below the date

INSITU TESTING

S	Standard Penetration Test - split barrel sampler
C	Standard Penetration Test - solid 60^o cone
SW	Self Weight Penetration
Ivp, HVp (R)	In Situ Vane Test, Hand Vane Test (R) demonstrates remoulded strength
K(F), (C), (R), (P)	Permeability Test
HP	Hand Penetrometer Test

MEASURED PROPERTIES

N	Standard Penetration Test - blows required to drive 300mm after seating drive
x/y	Denotes x blows for y mm within the Standard Penetration Test
x*/y	Denotes x blows for y mm within the seating drive
c_u	Undrained Shear Strength (kN/m^2)
CBR	California Bearing Ratio

ROTARY DRILLING SIZES

Index Letter	Nominal Diameter (mm)	
	Borehole	Core
N	75	54
H	99	76
P	120	92
S	146	113

Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Drilled By:	Borehole No.
KM	**RC01**
Logged By:	Sheet 1 of 3

Project Name:	Castlecomer Site Investigation	**Project No.**	P18243	**Co-ords:**	**Hole Type** Rotary cored
Location:	Co. Kilkenny			**Level:**	**Scale** 1:50
Client:	Kilkenny County Council			**Dates:**	16/10/2018 16/10/2018

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description
										Open hole boring. Driller described: (Made Ground)
		N=21 (7,4/5,6,5,5) (C)					1.50			Open hole boring. Driller described: Stiff Clay.
		N=19 (4,4/5,4,6,4) (C)								
		N=21 (6,4/5,4,6,6) (C)					4.50			Open hole boring. Driller described: Stiff, gravelly Clay.
	▼	N=30 (6,7/7,8,7,8) (C)					6.00			Open hole boring. Driller described: Stiff Clay.
		N=18 (4,5/5,4,4,5) (C)					7.50			Open hole boring. Driller described: Medium dense, 'wet' clayey Gravel.

Groundwater:

Struck, m	Rose to	After, min	Sealed	Comment
6.00				See shift data.

Hole Information:

Hole Depth (m)	Hole Dia (mm)	Casing Dia (mm)
19.50	76	131

Equipment:	Deltabase 520
Method:	Compressed air mist.

Remarks:

RC01 terminated at 19.5m bgl, required depth.

Shift Data:

Groundwater	Shift	Hole Depth	Remarks
	16/10/2018 08:00	0.00	Start of shift.
5.00	16/10/2018 18:00	19.50	End of borehole.

Priority Geotechnical Ltd. Tel: 021 4631600 Fax: 021 4638690 www.prioritygeotechnical.ie	Drilled By: KM Logged By:	Borehole No. **RC01** Sheet 2 of 3

Project Name:	Castlecomer Site Investigation	**Project No.** P18243	**Co-ords:**	**Hole Type** Rotary cored
Location:	Co. Kilkenny		**Level:**	**Scale** 1:50
Client:	Kilkenny County Council		**Dates:**	16/10/2018 16/10/2018

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description
		N=28 (6,6/7,6,7,8) (C)								Open hole boring. Driller described: Medium dense, 'wet' clayey Gravel.
		N=31 (7,7/8,7,8,8) (C)					10.50			Open hole boring. Driller described: Dense, Gravel.
		N=30 (7,9/8,7,7,8) (C)					12.00			Open hole boring. Driller described: Dense, clayey Gravel.
		N=20 (4,5/5,5,4,6) (C)					13.50			Open hole boring. Driller described: Stiff Clay.
		N=17 (6,6/4,5,4,4) (C)					15.00			Open hole boring. Driller described: Stiff, Clay with boulder content.
		N=27 (5,6/8,6,7,6) (C) 16.50 - 17.20		0	0	0	16.50			Core run attempted. No recovery. Driller described: Gravelly Boulders.
							17.20			Open hole boring. Driller described: Gravelly Boulders.
							18.00			

Groundwater:

Struck, m	Rose to	After, min	Sealed	Comment
6.00				See shift data.

Hole Information:

Hole Depth (m)	Hole Dia (mm)	Casing Dia (mm)
19.50	76	131

Equipment:	Deltabase 520
Method:	Compressed air mist.

Remarks:

RC01 terminated at 19.5m bgl, required depth.

Shift Data:

Groundwater	Shift	Hole Depth	Remarks
	16/10/2018 08:00	0.00	Start of shift.
5.00	16/10/2018 18:00	19.50	End of borehole.

Priority Geotechnical Ltd. Tel: 021 4631600 Fax: 021 4638690 www.prioritygeotechnical.ie	Drilled By: KM Logged By:	Borehole No. **RC01** Sheet 3 of 3

Project Name:	Castlecomer Site Investigation	**Project No.** P18243	**Co-ords:**	**Hole Type** Rotary cored
Location:	Co. Kilkenny		**Level:**	**Scale** 1:50
Client:	Kilkenny County Council		**Dates:**	16/10/2018 16/10/2018

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description
		N=35 (8,9/8,10,8,9) (C) 18.00 - 19.50		0	0	0	19.50			Core run attempted. No recovery. Driller described: Gravelly Boulders. End of Borehole at 19.500m

19 20 21 22 23 24 25 26 27

Groundwater:

Struck, m	Rose to	After, min	Sealed	Comment
6.00				See shift data.

Hole Information:

Hole Depth (m)	Hole Dia (mm)	Casing Dia (mm)
19.50	76	131

Equipment:	Deltabase 520
Method:	Compressed air mist.

Remarks:

RC01 terminated at 19.5m bgl, required depth.

Shift Data:

Groundwater	Shift	Hole Depth	Remarks
	16/10/2018 08:00	0.00	Start of shift.
5.00	16/10/2018 18:00	19.50	End of borehole.

Priority Geotechnical Ltd. Tel: 021 4631600 Fax: 021 4638690 www.prioritygeotechnical.ie	Drilled By: KM Logged By: SR	Borehole No. **RC02** Sheet 1 of 3

Project Name: Castlecomer Site Investigation	**Project No.** P18243	**Co-ords:**	**Hole Type** Rotary cored
Location: Co. Kilkenny		**Level:**	**Scale** 1:50
Client: Kilkenny County Council		**Dates:** 17/10/2018	17/10/2018

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description
										Open hole boring. Driller described: Gravel.
		N=15 (4,5/5,3,4,3) (C)					1.50			Open hole boring. Driller described: Firm becoming soft, 'wet' Clay.
		N=8 (2,2/1,3,2,2) (C)								
		N=4 (1,0/1,1,1,1) (C)								
	▼	N=5 (1,0/1,2,1,1) (C)								
		N=14 (2,2/3,4,3,4) (C)					7.50			Open hole boring. Driller described: Firm, Clay.

Groundwater:

Struck, m	Rose to	After, min	Sealed	Comment
6.00				See shift data.

Hole Information:

Hole Depth (m)	Hole Dia (mm)	Casing Dia (mm)
20.40	76	131

Equipment:	Deltabase 520
Method:	Compressed air mist

Remarks:

RC02 terminated at 20.40m bgl, required depth.

Shift Data:

Groundwater	Shift	Hole Depth	Remarks
	17/10/2018 08:00	0.00	Start of shift.
5.0	17/10/2018 18:00	20.40	End of borehole.

Priority Geotechnical Ltd. Tel: 021 4631600 Fax: 021 4638690 www.prioritygeotechnical.ie	Drilled By: KM Logged By: SR	Borehole No. **RC02** Sheet 2 of 3

Project Name:	Castlecomer Site Investigation	**Project No.** P18243	**Co-ords:**	**Hole Type** Rotary cored
Location:	Co. Kilkenny		**Level:**	**Scale** 1:50
Client:	Kilkenny County Council		**Dates:**	17/10/2018 17/10/2018

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / FI (/m)	Level (mOD)	Legend	Stratum Description
		N=15 (3,2/3,4,4,4) (C)								Open hole boring. Driller described: Firm, Clay.
		N=16 (4,3/4,4,3,5) (C)								
		N=16 (5,4/5,3,4,4) (C)					12.00			Open hole boring. Driller described: Medium dense, clayey Gravel.
		N=19 (5,6/5,4,5,5) (C)					13.50			Open hole boring. Driller described: Possible weathered rock with Clay. Assumed Shale lithology.
		~~0 (50 for 0mm/0 for 0mm)~~ 14.80 (C) 15.30		100	100	0	14.80			Lithology: Weak to moderately strong, dark grey, SHALE with Siltstone laminations throughout. Weathering: Fresh with light slay smearing along fracture surfaces and minor iron oxidation colouration. Fractures: 2 sets observed. Set 1 is dipping 0 to 10 degrees with undulating smooth to planar smooth fracture surfaces and very close to medium fracture spacing. Set 2 is dipping 80 to 90 degrees with undulating rough to planar smooth fracture surfaces and wide fracture spacing.
		15.30 - 16.80	5mm 145mm 80mm 50mm 320mm 310mm	100	100	67	18/m 5/m			
		16.80 - 18.30	20mm 100mm 80mm	100	100	9	11/m			

10 11 12 13 14 15 16 17 18

Groundwater:

Struck, m	Rose to	After, min	Sealed	Comment
6.00				See shift data.

Hole Information:

Hole Depth (m)	Hole Dia (mm)	Casing Dia (mm)
20.40	76	131

Equipment:	Deltabase 520
Method:	Compressed air mist

Remarks:

RC02 terminated at 20.40m bgl, required depth.

Shift Data:

Groundwater	Shift	Hole Depth	Remarks
	17/10/2018 08:00	0.00	Start of shift.
5.0	17/10/2018 18:00	20.40	End of borehole.

Priority Geotechnical Ltd. Tel: 021 4631600 Fax: 021 4638690 www.prioritygeotechnical.ie	Drilled By: KM Logged By: SR	Borehole No. **RC02** Sheet 3 of 3

Project Name: Castlecomer Site Investigation	**Project No.** P18243	**Co-ords:**	**Hole Type** Rotary cored
Location: Co. Kilkenny		**Level:**	**Scale** 1:50
Client: Kilkenny County Council		**Dates:** 17/10/2018	17/10/2018

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max, avg)	Coring (%) TCR	SCR	RQD	Depth (m) / FI (/m)	Level (mOD)	Legend	Stratum Description
			30mm 170mm 70mm				8/m			Lithology: Weak to moderately strong, dark grey, SHALE with Siltstone laminations throughout. Weathering: Fresh with light slay smearing along fracture surfaces and minor iron oxidation colouration. Fractures: 2 sets observed. Set 1 is dipping 0 to 10 degrees with undulating smooth to planar smooth fracture surfaces and very close to medium fracture spacing. Set 2 is dipping 80 to 90 degrees with undulating rough to planar smooth fracture surfaces and wide fracture spacing.
		18.30 - 19.80	40mm 160mm 90mm	93	93	19	10/m			
		19.80 - 20.40	50mm 150mm 130mm	100	100	62	6/m 20.40			End of Borehole at 20.400m

19 20 21 22 23 24 25 26 27

Groundwater:

Struck, m	Rose to	After, min	Sealed	Comment
6.00				See shift data.

Hole Information:

Hole Depth (m)	Hole Dia (mm)	Casing Dia (mm)
20.40	76	131

Equipment:	Deltabase 520
Method:	Compressed air mist

Remarks:

RC02 terminated at 20.40m bgl, required depth.

Shift Data:

Groundwater	Shift	Hole Depth	Remarks
	17/10/2018 08:00	0.00	Start of shift.
5.0	17/10/2018 18:00	20.40	End of borehole.

Photographic Record

Number:	**RC02**	**Project**	Castecomer	
		Project No	P18243	
		Engineer	RPS	

KEY TO SYMBOLS - LABORATORY TEST RESULT

U	Undisturbed Sample	
P	Piston Sample	
TWS	Thin Wall Sample	
B	Bulk Sample - Disturbed	
D	Jar Sample - Disturbed	
W	Water Sample	
pH	Acidity/Alkalinity Index	
SO_3	% - Total Sulphate Content (acid soluble)	
SO_3	g/ltr - Water Soluble Sulphate (Water or 2:1 Aqueous Soil Extract)	
+	Calcareous Reaction	
Cl	Chloride Content	
PI	Plasticity Index	
<425	% of material in sample passing 425 micron sieve	
LL	Liquid Limit	
PL	Plastic Limit	
MC	Water Content	
NP	Non Plastic	
Yb	Bulk Density	
Yd	Dry Density	
Ps	Particle Density	
U/D	Undrained/Drained Triaxial	
U/C	Unconsolidated/Consolidated Triaxial	
T/M	Single Stage/Multistage Triaxial	
100/38	Sample Diameter (mm)	
REM	Remoulded Triaxial Test Specimen	
TST	Triaxial Suction Test	
V	Vane Test	
DSB	Drained Shear Box	
RSB	Residual Shear Box	
RS	Ring Shear	
σ_3	Cell Pressure	
σ_1-σ_3	Deviator Stress	
c	Cohesion	
c_	Effective Cohesion Intercept	
ϕ	Angle of Shearing Resistance - Degrees	
ϕ_	Effective Angle of Shearing Resistance	
εf	Strain at Failure	
*	Failed under 1st Load	
**	Failed under 2nd Load	
#	Untestable	
##	Excessive Strain	
p_o	Effective Overburden Pressure	
m_v	Coefficient of Volume Decrease	
c_v	Coefficient of Consolidation	
Opt	Optimum	
Nat	Natural	
Std	Standard Compaction - 2.5kg Rammer	(¶ CBR)
Hvy	Heavy Compaction - 4.5kg Rammer	(§ CBR)
Vib	Vibratory Compaction	
CBR	California Bearing Ratio	
Sat m.c.	Saturation Moisture Content	
MCV	Moisture Condition Value	

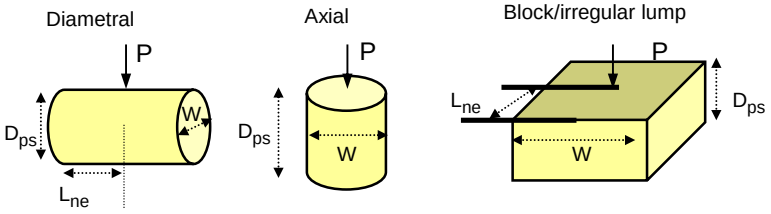
Point Load Strength Index Tests
Summary of Results

Project No.: P18243

Project Name: Castlecomer

Borehole No.	Sample			Specimen		Rock Type and Test condition	Test Type see ISRM		Failure Valid (Y/N)	Dimensions				Force P	Equivalent diameter, De	Point Load Strength Index		Remarks (including water content if measured)
	Depth	Ref.	Type	Ref.	Depth		Type (D, A, I, B)	Direction (L, P or U)		Lne	W	Dps	Dps'			I_s	$I_{s(50)}$	
	m				m					mm	mm	mm	mm	kN	mm	MPa	MPa	
RC02	15.00		C			SANDSTONE	D	U	YES	31.0	76.0	76.0	57.0	33.4	65.8	7.7	8.7	Rough Undulating
RC02	16.00		C			SANDSTONE	D	U	YES	69.0	69.0	76.0	76.0	23.7	72.4	4.5	5.3	Rough Undulating
RC02	17.40		C			SANDSTONE	D	U	YES	56.0	76.0	76.0	60.0	11.5	67.5	2.5	2.9	Stepped Rough
RC02	18.60		C			SILTSTONE	D	U	YES	78.0	78.0	76.0	66.0	0.8	71.7	0.1	0.2	Rough Undulating
RC02	20.05		C			SILTSTONE	D	U	YES	71.0	76.0	76.0	65.0	2.2	70.3	0.4	0.5	Rough Undulating

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction
L - parallel to planes of weakness
P - perpendicular to planes of weakness
U - unknown or random
Dimensions
Dps - Distance between platens (platen separation)
Dps' - at failure (see ISRM note 6)
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P



Test performed in accordance with ISRM Suggested Methods : 2007, unless noted otherwise
Detailed legend for test and dimensions, based on ISRM, is shown above.
Size factor, F = $(De/50)^{0.45}$ for all tests.

Date Printed: 23/11/2018

Approved By: Cilla

Table: 1

sheet: 1

Unconfined Compressive Strength, UCS

Job Name	**Castlecomer**	
Job Number	**P18243**	
Borehole:	**RC02**	
Depth:	**16.5**	**m**
Rock Type		
Bulk Density	**2.68**	**Mg/m^3**
Load at Failure, P	**205.9**	**kN**
Stress at Failure	**45.47**	**MPa**

Failure mode

Appendix C

Cost Estimate

Cost Estimate for Castlecomer Footbridge Options

Options	Deck Dimensions	Proposed Deck Area (m^2)	Price per m^2 ex.vat	Sub-total	15% Contingency for high level cost estimate	Total Cost Estimate	Cost Certainty
1 - Cantilever Structure	54.5m long x 2m wide	109.00	€5,081	€553,777	€83,067	€636,843	Low Cost Certainty
2 - Single Span Steel Footbridge	43.70m long x 2.50m wide	109.25	€8,647	€944,725	€141,709	€1,086,434	High Cost Certainty
3 - Two Span Glulam Footbridge	44.3m long x 2.50m wide	110.75	€9,628	€1,066,292	€159,944	€1,226,236	Low Cost Certainty
4 - Two Span Steel Footbridge	44.1m long x 2.50m wide	110.25	€7,119	€784,869	€117,730	€902,600	High Cost Certainty
5 - Single Span Glulam Deck / Steel Truss	44.05m long x 2.50m wide	110.13	€9,407	€1,035,932	€155,390	€1,191,322	Low Cost Certainty

Assumptions applicable to all options:

1 - Cantilever Structure

SCSI Tender Price Index

Basis For Costs — Cost for Cantilever Structure is derived from the Tender Sum of Comparable Cantilever Structures

2013 109

Second half 2018 147

Tender Sum of Three Lowest Tenders

Bridge	1	2	3	Average *	Area m^2	Avg cost/m^2 (Base Yr)	Avg cost/m^2 (2018)	% Adjustment	Description
Louisburgh (Bunowen), Mayo (2013)	€283,000	€268,000	€367,000	€306,000	160	€1,912.50	€2,596	25.00%	Multi Span Cantilever Walkway adjoining existing bridge

Adjustment of 25% to allow for buried anchorages between arches.

Average Adjusted cost/m^2 (super-structure): €3,245.52

Additional items not inlcuded in Louisburgh - Lighting, Knotweed Treatment, Landscaping €200,000 or €1835/m^2 €1,835.00

€5,080.52

2 - Single Span Steel Footbridge

Basis For Costs — Cost of Single Span Steel Footbridge is derived using average market rates from comparable items

Footbridge	Steel Cost € Per Tonne	Tonne	Steelwork Cost	Substructure	Bespoke Parapet	Ancillaries	Sub Total	Prelims at 15%	Total	Area m^2	Avg cost/m^2
Steel Box (650-940mm deep, 20mm Thick)	€6,500	66.00	€429,000	€75,000	€67,500	€250,000	€821,500	€123,225	€944,725	109.25	€8,647.37
Assumptions	Fabricated/Coated/ Delivered/Cranage	Allow 20% for joints, welds etc.			Assume €750/m for 2 x 45m parapets	Bearings, Lighting, stonework, landscaping, Knotweed Treatment					

Average cost/m^2: €8,647.37

3 - Two Span Glulam Footbridge

SCSI Tender Price Index

Basis For Costs — Cost of Two Span Glulam Footbridge is derived from comparable projects

2013 109

(October) 2017 137

Second half 2018 147

Footbridge	Superstructure Cost	Area m^2	Timber Cost/m^2 (Base Yr)	Glulam Cost/m^2 (second half 2018)	Total Glulam Cost	Substructure	Bespoke Parapet	Ancillaries	Sub Total	Prelims at 7.5% (allow glulam)	Total	Area m^2	Avg cost/m^2
Ossory Footbridge, Kilkenny (2013)	€275,000	82.5	€3,333.33	€4,525.35	€501,182.03	€100,000	€67,500	€250,000	€918,682	€68,901	€987,583	110.75	€8,917.2
Perrotts Inch Footbridge, Cork (2017)	€300,000	55	€5,454.55	€5,847.56	€647,617.11	€100,000	€67,500	€250,000	€1,065,117	€79,884	€1,145,001	110.75	€10,338.6
Assumptions	Fabricated/Coated/ Delivered/Cranage					Including cost of pier							

Average cost/m^2: €9,627.92

4 - Two Span Steel Footbridge

Basis For Costs — Cost of Two Span Steel Footbridge is derived using average market rates from comparable items

Footbridge	Steel Cost € Per Tonne	Tonne	Steelwork Cost	Substructure	Bespoke Parapet	Ancillaries	Sub Total	Prelims at 15%	Total	Area m^2	Avg cost/m^2
Steel Box (420-710mm deep, 20mm Thick)	€6,500	40.00	€260,000	€100,000	€72,495	€250,000	€682,495	€102,374	€784,869	110.25	€7,119.00
Assumptions	Fabricated/Coated/ Delivered/Cranage	Allow 20% for joints, welds etc.		Including cost of pier	Assume €750/m for 2 x 48.33m parapets	Bearings, Lighting, stonework, landscaping, Knotweed Treatment					

Average cost/m^2: €7,119.00

5 - Single Span Glulam Deck / Steel Truss Footbridge

SCSI Tender Price Index

Basis For Costs — Cost of Single Span Glulam Deck / Steel Truss is derived from comparable projects for glulam and market rates for steel truss

2013 109

(October) 2017 137

Second half 2018 147

Glulam Footbridge	Superstructure Cost	Area m^2	Glulam Cost/m^2 (Base Yr)	Glulam Cost/m^2 (second half 2018)	Total Glulam Cost	Substructure	Bespoke Parapet	Ancillaries	Sub Total	Prelims at 7.5% (allow glulam)	Total	Area m^2	Avg cost/m^2
Ossory Footbridge, Kilkenny (2013)	€275,000	82.5	€3,333.33	€4,525.35	€498,353.69	€75,000	€67,500	€250,000	€890,854	€66,814	€957,668	110.13	€8,696.2
Perrotts Inch Footbridge, Cork (2017)	€300,000	55	€5,454.55	€5,847.56	€643,962.39	€75,000	€67,500	€250,000	€1,036,462	€77,735	€1,114,197	110.13	€10,117.6
Assumptions	Fabricated/Coated/ Delivered/Cranage												

Average cost/m^2: €9,406.88

	Steel Cost € Per Tonne	Tonne	Steelwork Cost	Area m^2	Avg cost/m^2
Steel Truss	€6,500	13.75	€89,403	110.13	€811.8
	Fabricated/Coated/ Delivered/Cranage	Allow 20% for joints, welds etc.			

Lusas check gave 14.11 tonne

Steel Truss Members	kg/m
CHS bottom chord	134
2 x CHS struts at 45°	25.7
2 x I Beams	43
SHS every 4m	28.1

Total Average cost/m^2: €10,218.7

Appendix D

Cultural Heritage Assessment

JOHN CRONIN & ASSOCIATES
ARCHAEOLOGY | CONSERVATION | HERITAGE | PLANNING

Proposed footbridge, Castlecomer, County Kilkenny

Archaeological and architectural heritage assessment

Prepared by
John Cronin & Associates
3 Westpoint Business Centre
Link Road
Ballincollig
County Cork

On behalf of
RPS Group
Innishmore
Ballincollig
Co Cork

May 2019

Document Control Sheet

Client	RPS Group				
Project Title	Castlecomer Pedestrian Bridge				
Document Title	Archaeological and built heritage assessment				
Document No.	JCA 19-012				
Document Comprises	DCS	NTS	TOC	Pages	46
	1	0	1	Appendices	2

Rev	*Status*	*Author(s)*	*Reviewed By*	*Approved By*	*Office of Origin*	*Issue Date*
01	Draft	P. Dunne and J. Cronin	T. Cummins	J. Cronin	Ballincollig	27/05/19

Contents

1. Introduction

John Cronin & Associates have been commissioned by RPS Group on behalf of their client Kilkenny County Council to undertake cultural heritage impact assessment of proposed works to construct a new pedestrian footbridge on the upstream side of the existing Castlecomer Bridge on the eastern side of Castlecomer town, County Kilkenny (**Figure 1**). The existing bridge forms the N78 crossing of the River Dinin. The new structure will not be attached to the existing bridge and will comprise a two-span steel bridge with a central in-river pier which will be supported on a rectangular pile-cap of 4 no. Piles. The top of the pile-cap will be set just below bed level of the river to ensure no impact on flow.

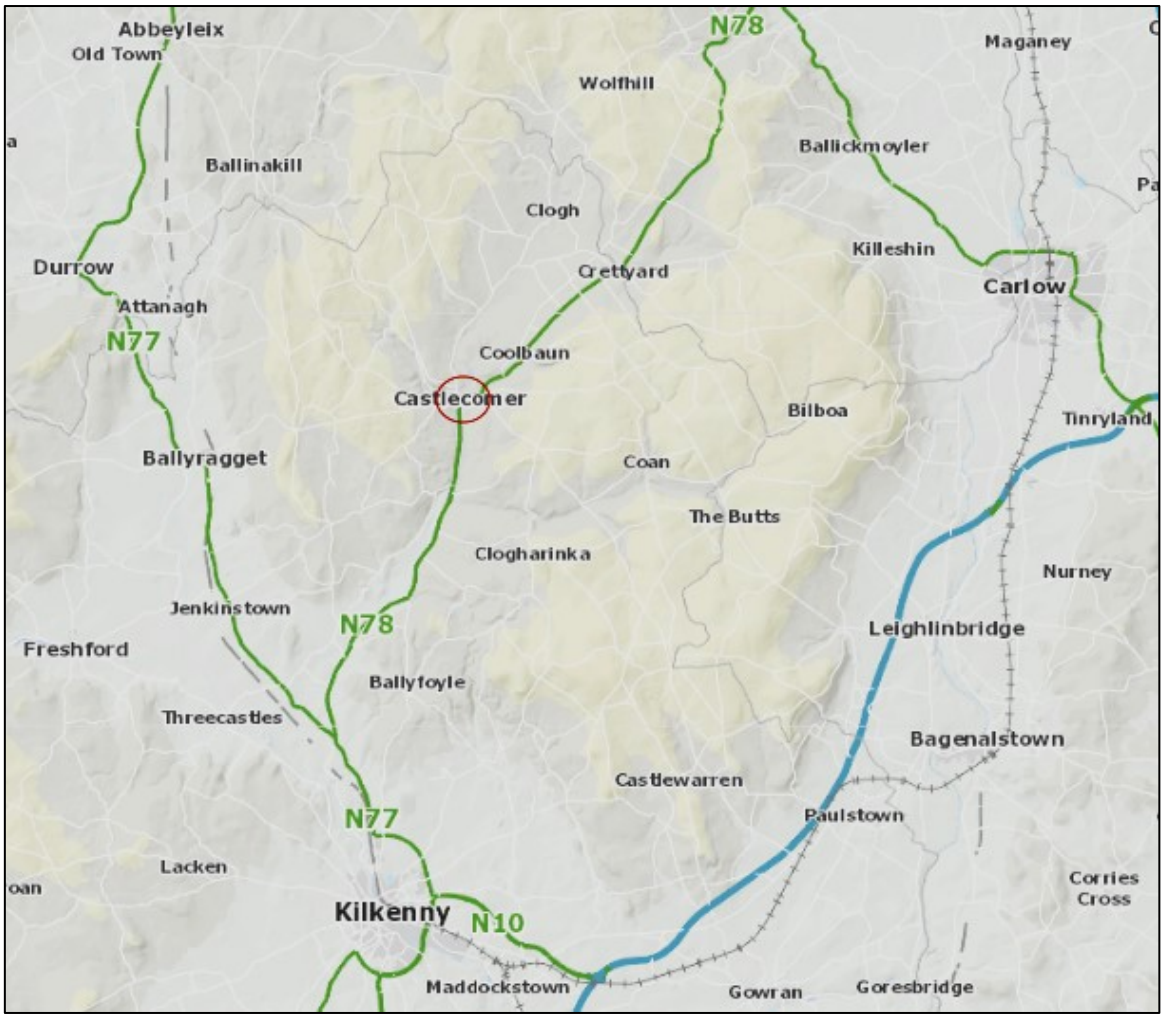


Figure 1: *General location map (Reproduced under Ordnance Survey Ireland Licence No. SU 0003319)*

Castlecomer Bridge **is not a recorded archaeological monument**, but it is located within the Zone of Notification (ZON), as designated by the National Monuments Service (NMS), surrounding the historic town of Castlecomer (KK005-082----). The bridge is listed as a protected structure in the Record of Protected Structures (RPS Ref. no. D13) published in the current Kilkenny County Development Plan (2014). The bridge is rated as being of **national importance** in the National Inventory of Architectural Heritage (NIAH no. 12301001) survey of bridges and other historic structures in County Kilkenny.

This assessment has been informed by desktop research and site inspections undertaken in October and November 2018 and in April 2019. The extent of the study area reviewed for this assessment comprised the existing bridge, its close environs and surrounding lands within a 250m wide area extending in all directions. Detail on the design of the proposed scheme presented within this report is based on available information provided to John Cronin & Associates in May 2019.

The report seeks to assess the impacts of the proposed development on the bridge and on other known and potential elements of the archaeological and archaeological heritage resources within the area. Based on this assessment, appropriate mitigation strategies are then recommended.

Section 2 of this report provides a summary of the methodology used in its compilation. **Section 3** then provides a summary of the Irish legal and policy frameworks designed to protect the archaeological and architectural heritage resources. This section also identifies the designated archaeological and architectural heritage constraints within the study area as well as the results a desktop study and site inspection undertaken to assess potential impacts, including those on hitherto undesignated or unrecorded features within the project area. An assessment of these potential impacts, which is based on project details available at the time of writing, is presented in **Section 4**. A summary of potential impacts is then presented in **Section 5** and is followed by **Section 6** which collates the assessment conclusions and recommends appropriate mitigation measures to be adopted prior to and during the construction phase of the proposed project. A list of consulted sources is provided in **Section 7**. Extracts of the photographic record compiled three separate site inspections are provided in **Appendix 1** and extracts from relevant consulted datasets are presented in **Appendix** 2.

2. Methodology

Desktop Study

The assessment commenced with a programme of desktop research on the study area which was undertaken in order to identify known and potential archaeological and architectural heritage constraints. The Sites and Monuments Record (SMR) and the Record of Monuments and Places (RMP) for County Kilkenny, both published by the Archaeological Survey of Ireland, were the principal sources consulted for identifying known archaeological sites. The Record of Protected Structures (RPS) and the National Inventory of Architectural Heritage (NIAH) were consulted to assess the designated architectural heritage resource. Details on the legal and planning frameworks designed to protect these elements of the archaeological and architectural heritage resources are presented in Section 3 of this report.

In addition, the following sources were consulted as part of the desktop study:

- *Historic Map Viewer:* This online resource presents available summary descriptions of recorded archaeological sites and the relevant entries are presented in **Appendix 2**. Current information was reviewed at www.archaeology.ie on 07/05/19.

- *Cartographic Sources* - The cartographic sources examined for the study area include the Down Survey (1650s), the 1st edition of the 6-inch Ordnance Survey (OS) maps (surveyed and published in the 1830s-40s) and the 25-inch OS maps (surveyed and published 1887-1913).

- *Aerial photography* –A review of publicly-accessible aerial photographic sources from the Ordnance Survey, Google and Bing Maps was undertaken.

- *Literary Sources* - various published sources were consulted and references are provided in Section 7 of this report

- *Development Plans* - These plans outline local authorities' policies for the conservation of the archaeological and architectural heritage resource and include the Record of Protected Structures (RPS) and any designated Architectural Conservation Areas (ACAs). The Kilkenny County Development Plan 2014-2020 and the Castlecomer Local Area Plan 2018-2024 were reviewed as part of the assessment

- *Database of Irish Excavation Reports* - This online database contains summary accounts of licensed archaeological excavations carried out in Ireland. The database entries for investigations carried within the vicinity of the subject area are provided in **Appendix 2** of this report. Current data was accessed via www.excavations.ie on 07/05/19.

- *UNESCO World Heritage Sites and Tentative List:* UNESCO seeks to encourage the identification, protection and preservation of cultural and natural heritage around the world considered to be of outstanding value to humanity. There are two world heritage

sites in Ireland and a number of other significant sites are included in a Tentative List (2010) that has been put forward by Ireland for inclusion.

- *National Inventory of Architectural Heritage* - The function of the National Inventory of Architectural Heritage (NIAH) is to record built heritage structures within the Republic of Ireland and to advise local authorities in relation to structures of interest within their areas. Listing on the NIAH does not necessarily carry any statutory protection but does highlight the culturally significant aspects of the structure which ought to be conserved.

- *Irish Heritage Council: Heritage Map Viewer* - This online mapping source collates various cultural heritage datasets and includes extracts from the National Museum of Ireland's records of artefact discovery locations as well as datasets provided by, among others, the National Monuments Service, local authorities, the Royal Academy of Ireland and the Office of Public Works. Current data was accessed via www.heritagemaps.ie

Site inspection
The bridge was inspected on three different occasions by staff members of John Cronin & Associates.

Assessment of impact types
The methodology used to assess potential impacts has been informed by guidelines published in the Transport Infrastructure Ireland (TII) *Guidelines for the Assessment of Archaeological /Architectural Heritage Impacts of National Road Schemes*.

Consultation
The design of the bridge has been informed by ongoing consultation with the Department of Culture, Heritage and the Gaeltacht (DoCHG). Representatives of the DoCHG attended Project Review Meetings along with a Project Archaeologist from Transport Infrastructure Ireland (TII) and the Conservation Officer of Kilkenny County Council. The input of representatives from DoCHG, TII and Kilkenny County Council influenced the selection of the preferred intervention/design of the proposed pedestrian bridge and critically, moved the design away from affixing a cantilevered structure to the existing bridge.

3. Context

General Location

The bridge is located at the east end of the High Street on the eastern approach from Athy into Castlecomer in County Kilkenny and carries the N78 two-way road across the Dinin River. The bridge extends from the townland of Castlecomer on the west bank of the River Dinin to Castlecomer Demesne on the east bank.

From its earliest development, the topography and geology of the area has defined Castlecomer town's history. The Castlecomer Plateau is an upland plateau that surrounds the town to form a discrete landscape unit within the region and its coal deposits have meant that it is one of the few areas in Ireland with a history of coal-mining. The plateau is bounded on the east by the River Barrow, the west by the River Nore and is bisected by the Dinin River.

Figure 2: ***Location of Castlecomer Bridge (Reproduced under Ordnance Survey Ireland Licence No. SU 0003319)***

Legal and Policy Framework

The management and protection of cultural heritage in Ireland is achieved through a framework of national laws and policies which are in accordance with the provisions of the Valetta Treaty (1995) (formally the *European Convention on the Protection of the Archaeological Heritage, 1992*) ratified by Ireland in 1997; the *European Convention on the Protection of Architectural Heritage* (Granada Convention, 1985), ratified by Ireland in 1997; and the *UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage, 2003*, ratified by Ireland in 2015.

The locations of World Heritage Sites (Ireland) and the Tentative List of World Heritage Sites submitted by the Irish State to UNESCO were reviewed and none are located within the region of the country containing the study area.

The national legal statutes and guidelines relevant to this assessment include:

- National Monuments Act (1930) (and amendments in 1954, 1987, 1994 and 2004);
- Heritage Act (1995);
- National Cultural Institutions Act (1997);
- Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act (1999);
- Planning and Development Act (2000);
- *Architectural Heritage Protection: Guidelines for Planning Authorities*, Department of Arts, Heritage, and the Gaeltacht (2011); and
- *Framework and Principles for the Protection of the Archaeological Heritage*, Department of Arts, Heritage, Gaeltacht and the Islands, 1999.
- *TII Guidelines for the Assessment of Archaeological Impacts of National Road Schemes*
- *TII Guidelines for the Assessment of Architectural Heritage Impacts of National Road Schemes.*

Archaeological Heritage

This project is covered by the Code of Practice for Archaeology agreed between the Minister for Arts, Heritage, Regional, Rural and Gaeltacht Affairs and Transport Infrastructure Ireland (TII). An overview of the legal framework designed to protect the Irish archaeological resource is available in the TII *Guidelines for the Assessment of Archaeological Impacts of National Road Schemes*[1] and a summary follows hereafter.

The administration of national policy in relation to archaeological heritage management is the responsibility of the National Monuments Service (NMS) which is currently based in the Department of Culture, Heritage and the Gaeltacht. The National Monuments Act of 1930, and its Amendments, are the primary means of ensuring the satisfactory protection of the archaeological resource. They include a number of provisions that are applied to secure the protection of archaeological monuments. These include the designations of nationally significant sites as National Monuments, the Register of Historic Monuments (RHM), the Record of Monuments and Places (RMP), the Sites and Monuments Record (SMR), and the placing of Preservation Orders and Temporary Preservation Orders on endangered sites.

Section 2 of the National Monuments Act, 1930 defines a National Monument as *'a monument or the remains of a monument, the preservation of which is a matter of national importance'*. The State may acquire or assume guardianship of examples through agreement with landowners or under compulsory orders. Archaeological sites within the ownership of local authorities are also deemed to be National Monuments. There are no National Monuments in the ownership or guardianship of the State within the study area.

[1] http://www.tiipublications.ie/downloads/SRM/22-Archaeology-Planning-Guidelines-2005.pdf

The National Monuments (Amendment) Act, 1994 made provision for the establishment of the RMP, which comprises the known archaeological sites within the State. The RMP, which is based on the earlier RHM and SMR, comprises county-based lists of all recorded archaeological sites with accompanying maps. All RMP sites receive statutory protection under the National Monuments Act 1994 and the NMS must be given two months' notice in advance of any works proposed at their locations. The NMS have applied designated areas surrounding the recorded locations of archaeological sites known as Zones of Notification (ZON) and the extent of these are indicated on the Historic Heritage Viewer. There are seven recorded archaeological sites, and one redundant record, located within the study area boundary (**Table 1** and **Figure 3**).

The *Kilkenny Development Plan 2014* includes the following objective in relation to the protection of the archaeological resource:

> *8I Protect archaeological sites and monuments (including their setting), underwater archaeology, and archaeological objects, including those that are listed in the Record of Monuments and Places, and in the Urban Archaeological Survey of County Kilkenny or newly discovered sub-surface and underwater archaeological remains.*

In Section 8.3.1 of the County Development Plan, Development Management Standards in relation to archaeological heritage are stated as follows:

- *Endeavour to preserve in situ all archaeological monuments, whether on land or underwater, listed in the Record of Monuments and Places (RMP), and any newly discovered archaeological sites, features, or objects by requiring that archaeological remains are identified and fully considered at the very earliest stages of the development process and that schemes are designed to avoid impacting on the archaeological heritage.*
- *To require archaeological assessment, surveys, test excavation and/or monitoring for planning applications in areas of archaeological importance if a development proposal is likely to impact upon in-situ archaeological monuments, their setting and archaeological remains.*
- *Ensure that development within the vicinity of a Recorded Monument is sited and designed appropriately so that it does not seriously detract from the setting of the feature or its zone of archaeological potential. Where upstanding remains of a Recorded Monument exist a visual impact assessment may be required to fully determine the effect of any proposed development.*
- *Require the retention of surviving medieval plots and street patterns and to facilitate the recording of evidence of ancient boundaries, layouts etc. in the course of development.*
- *Safeguard the importance of significant archaeological or historic landscapes from developments that would unduly sever or disrupt the relationship, connectivity and/or inter-visibility between site*

The *Draft Castlecomer Local Area Plan 2018* includes the following objectives in relation to both the archaeological and architectural heritage resources:

> *H6 To protect and preserve items of both architectural and archaeological heritage from inappropriate development that would adversely affect and/or detract from the interpretation and setting of these sites. These include recorded monuments, structures contained in the Record of Protected Structures, the National Inventory of Architectural Heritage and structures within the Architectural Conservation Area.*

HDMS10 Require consultation with the Council's Heritage and Conservation Officers to ensure the protection of archaeological heritage of the town and the associated historic landscape. This includes terrestrial archaeology and underwater archaeology for in river works.

HDMS11 Ensure that all applications within the zone of archaeological interest or in close proximity to monuments are referred for archaeological assessment and also in accordance with national policy on large scale development sites where there are no previous recorded monuments.

Architectural heritage

An overview of the legal framework designed to protect the Irish architectural heritage resource is presented in the TII *Guidelines for the Assessment of Architectural Heritage Impacts of National Road Schemes*[2]. In summary, protection of architectural heritage is provided for through a range of legal instruments that include the Heritage Act (1995), the Architectural Heritage (National Inventory) & National Monuments (Misc. Provisions) Act (1999), and the Planning and Development Act (2000).

The Heritage Act (1995) (as amended) defines architectural heritage as including: *all structures, buildings, traditional and designed, and groups of buildings including streetscapes and urban vistas, which are of historical, archaeological, artistic, engineering, scientific, social or technical interest, together with their setting, attendant grounds, fixtures, fittings and contents.*

The National Inventory of Architectural Heritage (NIAH) was established under the Architectural Heritage Act (1999), to record architectural heritage structures within the State and to advise local authorities in relation to structures of architectural heritage significance within their administrative areas. Castlecomer Bridge is included in the County Kilkenny NIAH (ref 12301001) which rates the structure as being of national significance. The other NIAH structures within the study area are listed in **Table 2** and their locations are indicated on **Figure 3**.

The conservation principles of care and protection of architectural heritage and the facilitation of the listing of significant buildings of architectural merit are set out in Part IV of the Planning and Development Act (2000). This requires Local Authorities to maintain a Record of Protected Structures (RPS) of structures with special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest, to be included in their Development Plans. Any changes that materially affect the character of a protected structure require planning permission. In addition, Local Authorities must provide for the preservation of townscapes of heritage significance through the designation of Architectural Conservation Areas (ACAs). As previously noted, Castlecomer Bridge is listed as a protected structure (RPS D13) in the current Kilkenny Development Plan (2014). The bridge is located outside the Castlecomer ACA as delimited in the *Draft Castlecomer Local Area Plan* 2018-2014, which shows the area east end of its boundary terminating at the structure's west end.

The Kilkenny Development Plan (2014) includes the following relevant objective in relation to the protection of the architectural heritage resource within the County:

[2] http://www.tiipublications.ie/downloads/SRM/24-Architectural-Planning-Guidelines-2005.pdf

8K To ensure the protection of the architectural heritage of County Kilkenny by including all structures considered to be of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest in the Record of Protected Structures.

In relation to Record of Protected Structures, 8.3.5.1 of the current County Development Plan's development management standards are as follows:

- *The Council will have regard to the Architectural Heritage Protection Guidelines when assessing proposals for development affecting a protected structure.*
- *To encourage the sympathetic retention, reuse and rehabilitation of protected structures and their setting*

Archaeological and historical context

The following section provides a summary of the development of Castlecomer town with reference to recorded archaeological sites located within the study area. The dating framework used for archaeological periods is based on *Guidelines for Authors of Reports on Archaeological Excavations* as published by the National Monuments Service (NMS).

Datasets have been interrogated and retrieved from State and Local authorities and are considered accurate and current per publicly available sources (Archaeological datasets Historic Map Viewer at www.archaeology.ie; archaeological excavation results at www.excavations.ie, NIAH datasets at www.buildingsofireland.ie as well as the RPS published in the Kilkenny Development Plan 2014).

In summary, there are seven recorded archaeological sites located within the study area, including the *Zone of Notification* (ZON) surrounding the historic core of Castlecomer town, and these all date from the medieval period onwards (**Table 1**). A battlefield site (KK005-102----) is indicated immediately to the east of the bridge on the Historic Map Viewer (Figure 3). This comprises an indicative location for this recorded archaeological site which encompasses various townlands in the surrounding landscape. There are no other recorded archaeological sites located within 90m of the bridge (**Table 1**).

Figure 3: *Extract from Historic Environment Viewer showing the location of archaeological sites within study area (red line) and their surrounding Zones of Notification (shaded). NIAH listed structures are indicated with blue dots and bridge location with an arrow*

Table 1*: Recorded archaeological sites located within study area*

Monument No.	***Class***	***ITM ref***	***Approx. distance from bridge***
KK005-102----	*Battlefield*	*653610, 673050*	*Extends throughout study area*
KK005-104----	*Bastioned fort*	*653780, 673101*	*150m to west*
KK005-082----	*Historic town*	*653389, 673030*	*ZON extends over bridge*
KK005-081----	*House 16th/17th century*	*653662, 672969*	*90m to southeast*
KK005-057----	*Redundant record*	*653780, 673039*	*180m to east*
KK005-033001-	*Castle – unclassified*	*653756, 673088*	*160m to east*
KK005-033002-	*Castle – motte*	*653756, 673088*	*160m to east*
KK005-033003-	*Outwork*	*653779, 673102*	*180m to east*

The historic core of Castlecomer town has been designated as a recorded archaeological site by the Archaeological Survey of Ireland (KK005-082----). The town takes its name from a motte and

castle (RMP KK005-035---) constructed in lands to the east of the river to control a crossing point. The motte was probably erected during the initial Anglo-Norman incursions in the late 12th century (Carrigan 1905, vol .2 158-9). The *'Liber Primus Kilkenniensis'* records that in *c.*1200 the castle and an associated settlement were burned by the O'Brenans (Orpen 1909, 318-19). Although the exact location of the settlement is unclear, tradition links it with the 'Garrison' located near Castlecomer House. Orpen also records the following, 'just before the death of the younger William Marshal in 1231, he obtained a grant for forty days of his service due to the king to enable him "to fortify his castle of Cumbre [Castlecomer]". In 1295, Edward I gave the custody of the castle of Combre to Richard le Erecedekne [Archdeacon], to fight the enemies of the king. The first actual mention I have noted of a [stone] castle here was in 1289' *(ibid*.). In 1328 Castlecomer was burned by William de Bermingham and in 1374, a now unlocated church at Castlecomer was recorded as being in the possession of St. John's Abbey in Kilkenny.

In 1635, Sir Christopher Wandesforde began the construction of a new settlement, the design of which was based on the Italian town of Alsinore and also contained a new church building. He also planted English colonists, exploited the local anthracite mines and introduced haymaking to the district. In 1641, the new town came under siege from forces loyal to the Confederation Parliament in Kilkenny and the castle which stood on the motte, or the 'Garrison', to the east of the river was besieged by the Confederate army in 1641 for over three months (Carrigan 1905, vol .2 158-9). The church was destroyed as many settlers had taken refuge there and, while its former location is unknown, it is possible that the existing Church of Ireland (RMP No. KK006-001---) was built on its former site. The 17th century Down Survey mapping shows a castle structure in the area, which is named 'Castlecumber'. The mapping shows no bridge extending over the adjacent section of the river or major routeways leading to the settlement.

The following summary of the battle of Castlecomer during the 1798 rebellion is based on Musgrave's *Memoirs of the Different Rebellions in Ireland, Vol. 2* (1802). In the aftermath of the defeat at Vinegar Hill on June 21st, 1798, the United Irishmen left County Wexford and set towards Castlecomer with a force of 5,000 men. Major General Charles Asgil then advanced from Kilkenny City with about 1,000 men to relieve the Castlecomer garrison and sent an advance force of approx. 100 men to augment the 300 or so already there who were under the command of Walter Butler, the future 18th Earl of Ormonde. On June 24th the advancing United Irishmen defeated a force of about 250 men at Coolbawn located a mile and a half from Castlecomber town. They then advanced to the town in two columns, one under Father Murphy and the other under Miles Byrne. The columns eventually joined forces within the town, and it has been recorded that 50 Loyalists were killed in the fighting which caused much damage to the town with much of it burnt down. They then set out to assault Castlecomer House, which was also burnt, and diverted to meet Asgil's relief force which had arrived on the heights outside the town. Asgil's artillery covered the retreat of the trapped garrison and held the high ground until they had made their escape.

The National Folklore Collection UCD Digitization Project (www.duchas.ie) records the following local story relating to the battle[3]:

> *Just about 200 yards beyond the Deer-Park Castlecomer there is a bridge and in that very spot some of the men of the rebellion of 1798 fought. There was a fierce battle fought and a lot of the men of 1798 were killed. In the field at the far side there are a few bushes grown up, and there are two or three head stones in the middle of the bushes.*

[3] https://www.duchas.ie/en/cbes/4758573/4755880/4922870

As a result of the conflict, little remains of the town from the period prior to 1800 and it was thereafter extensively redeveloped by the Wandesforde family in the general form that currently exists. As the Wandesforde family intended to develop their land acquisitions commercially, the emphasis of the new town was on commerce with a central axis centred on a large marketplace, which corresponds to the present square. A number of houses were built to provide for workers in the coal mining and iron smelting enterprises that were developed in the 19th century. These houses have consistency in character, all having been built around the same time after 1800.

Castlecomer experienced rapid population growth in the early 19th century and the effects of the Famine in the middle of the century were particularly severe in the area. In an effort to cope with the ensuing crisis, a workhouse was opened in 1853. The Roman Catholic Church of the Immaculate Conception in the 1840s and the Presentation Sisters set up the present convent on the site of the old fever hospital in 1885. The town's principal economic drivers included the wealth generated from the mining resources of the immediate area in addition to its role as a principal market town for North Kilkenny. Since the loss of the mining industry as a major employer in 1969, the town's main role has been as a service centre for its rural hinterland.

The following extract from Samuel Lewis' 1837 *Topographical Dictionary of Ireland* describes the history, civic amenities and geography of Castlecomer and its hinterland, in the early part of the 19th-century:

> *CASTLECOMER, a market and post-town, and a parish, in the barony of FASSADINING, county of KILKENNY, and province of LEINSTER, 9.50 miles from Kilkenny city, and 46 (S. W.) from Dublin ; containing 13,242 inhabitants, of which number, 2436 are in the town.*
>
> *This town is situated on the river Deen, and on the road from Kilkenny by Athy (Co. Kildare), to Dublin. It suffered greatly in the disturbances of 1798, from the violence of a party of the insurgents, by whom a considerable portion of the town was destroyed. It was, however, soon restored, and at present consists of one wide main street and several smaller, containing, in 1831, 455 houses, chiefly inhabited by persons engaged in the extensive collieries in the parish and neighbourhood. The infantry barracks, a, neat range of buildings, are adapted for 8 officers and 126 non-commissioned officers and privates, with suitable offices. The market is chiefly for provisions, and some neat shambles have been erected. Fairs are held on March 27th, May 3rd, June 2lst, Aug. 10th, Sept. l4th, Oct. 28th, and Dec. 14th. A constabulary police force is stationed here; the quarter sessions for the county once in the year (in June,) and petty sessions every Friday, are held in the town; and a court for the recovery of small debts is held by the seneschal of the manor.*
>
> *The parish comprises 21,708 statute acres and contains the principal portion of the extensive coal field of the district…. These collieries have been worked for more than a century: the regular strata were first discovered in digging of iron-ore in that part of the territory of Ida which belonged to the Brenans, and which was purchased from that sept, in the reign of Chas. I., by Sir Christopher Wandesford, and erected into a lordship by charter of the same monarch. Its extent at that time was estimated at 13,400 plantation acres; and the father of the last Lord Wandesford was the first who worked the pits to any advantage. The principal workings are all between the small river Deen, which flows by the towns and the hills to the east and north-east, extending towards Donane. The substratum on which the coal rests is remarkable for withstanding the agency of fire, and has been used with great success in the making of fire-bricks; the depth of the pits varies from 31 to 39 yards. The chief property in these mines was vested in the Wandesford family, to whom this place gave the title of Earl, now extinct, and whose representative, the Hon. Charles Butler Wandesford, brother of the Marquess of Ormonde, inherited in right of his mother, the sister of the late Lord Wandesford, and has a handsome modern residence adjoining the town. A great portion of the coal is conveyed through the southern counties by the rivers Suir and Barrow, and by the Grand Canal to Dublin. …There are a bleach-green and a grist-mill in the parish.*

The living is a rectory and vicarage, in the diocese of Ossory and in the patronage of the Crowns the tithes amount to £969. 4s. 7.50 d. The church, situated in the town, is a neat edifice with a tower; and there is a chapel of ease at Mooneenroe, in the collieries, built by subscription aided by a grant from the late Board of First Fruits, in 1818. Lectures on religious subjects are delivered also in the school-rooms adjoining the church and chapel of ease. The glebe-house was built by aid of a gift of £100 and a loan of £1500 from the same Board, in 1819.

In the Roman Catholic divisions the parish forms part of the three several unions or districts of Castlecomer, Clough, and Muckalee, the first of which comprises about one-half of it: there are four chapels belonging to these unions, one of which is in the town. There is also a place of worship for Wesleyan Methodists.

Near the R. C. chapel is a convent and adjoining it a school under the care of the nuns. The schools adjoining the parish church and chapel of ease are supported by an annual donation of £100 from the Hon. C. B. Wandesford, and £34 from the rector; an infants' schooled also supported by subscription. In these schools about 380 children receive gratuitous instruction; and there are also eight pay schools, in which are about 330 children, and three Sunday schools. A dispensary was elected by the Countess of Ormonde, and an auxiliary branch of the Hibernian Bible Society has been established in the town.

History of the Bridge

The existing bridge was erected by George Smith between 1763 and 1767 to replace an earlier bridge which had washed away during a great flood which occurred on 2nd October 1763. It was one of a number of bridges on the Nore and its main tributaries that were rebuilt or replaced in the 1760s under the administration of the Commissioners for Inland Navigation.

Smith was an engineer with the Inland Navigation Corporation who were engaged constructing the Kilkenny Canal between 1755 and 1775. Reputed to have worked with George Semple (fellow engineer and architect who was the author of *A Treatise of Building on Water* in 1776) on Essex Bridge in Dublin (later remodelled as Grattan Bridge). Smith incorporated Palladian-styled niches in the spandrels between the five segmental arches of Castlecomer Bridge. These are reminiscent to the pedimented niches seen on Green's Bridge in Kilkenny, which was also constructed to his designs in the 1760s. The extract reproduced below from the 1801 record of Presentments (payments for works) from the Grand Jury[4] in Kilkenny County documents repairs to the bridge costing £41 6S.

To the Hon. James Butler, David Ryan, Esq. and Ambrose L. Williams, to repair the bridge of Castlecomer, on the mail-coach road from Castlecomer to Athy, -	41	6	0

In 1896, Susannah Proctor Flory publish a book titled *Fragments of Family History* in which she describes houses situated adjacent to the bridge prior to their destruction during the 1798 rebellion. These descriptions were sourced from first-hand accounts of occupants and include several sketches drawn based on their descriptions. The sketch shown in **Figure 4** shows the existing bridge structure and the houses to the east and west which were burned to the ground in 1798.

[4] https://books.google.ie/books?id=ZwEIAAAAQAAJ&pg=RA1-PA35&lpg=RA1-PA35&dq=castlecomer+bridge+repair&source=bl&ots=TlhbIcIEcZ&sig=bJlwu3YPaBWDjXZ6stZtv-bmq7c&hl=en&sa=X&ved=2ahUKEwiQi6fK3o3eAhWKLsAKHUVnBBUQ6AEwBXoECAQQAQ#v=onepage&q=castlecomer%20bridge%20repair&f=false

The bridge and the existing road approaches on both sides are present on the Taylor and Skinner 1777 Road Map of Ireland (**Figure 5**) as well as on the first edition 6-inch OS map (surveyed 1830s-40s) and the 25-inch edition map (1888-1913 series), both of which show a weir in the channel to the north (**Figures 6 and 7**).

Figure 4: *The bridge of Castlecomer prior to the rebellion of 1798 (after Proctor Flory 1896)*

Figure 5: *Extract from Taylor and Skinner's 1777 Road Map of Ireland showing Castlecomer Bridge*

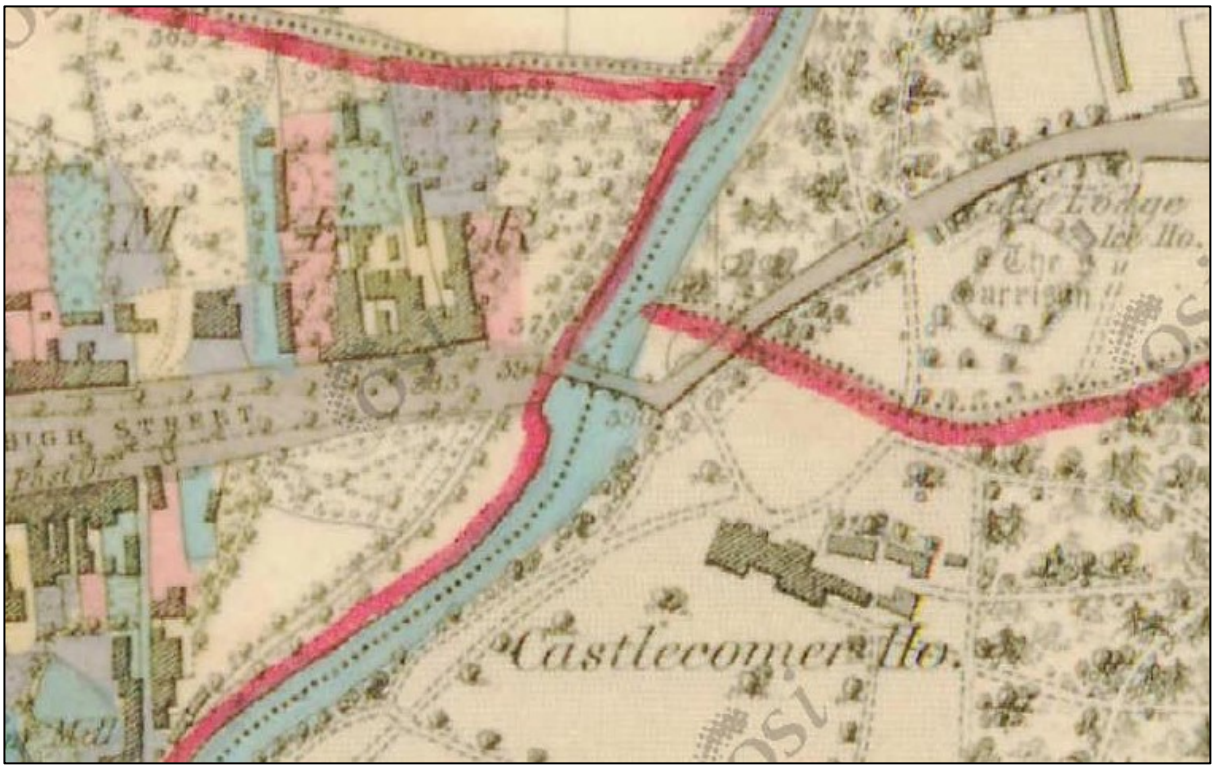


Figure 6: *Extract from the first edition Ordnance Survey map showing Castlecomer Bridge (Reproduced under Ordnance Survey Ireland Licence No. SU 0003319)*

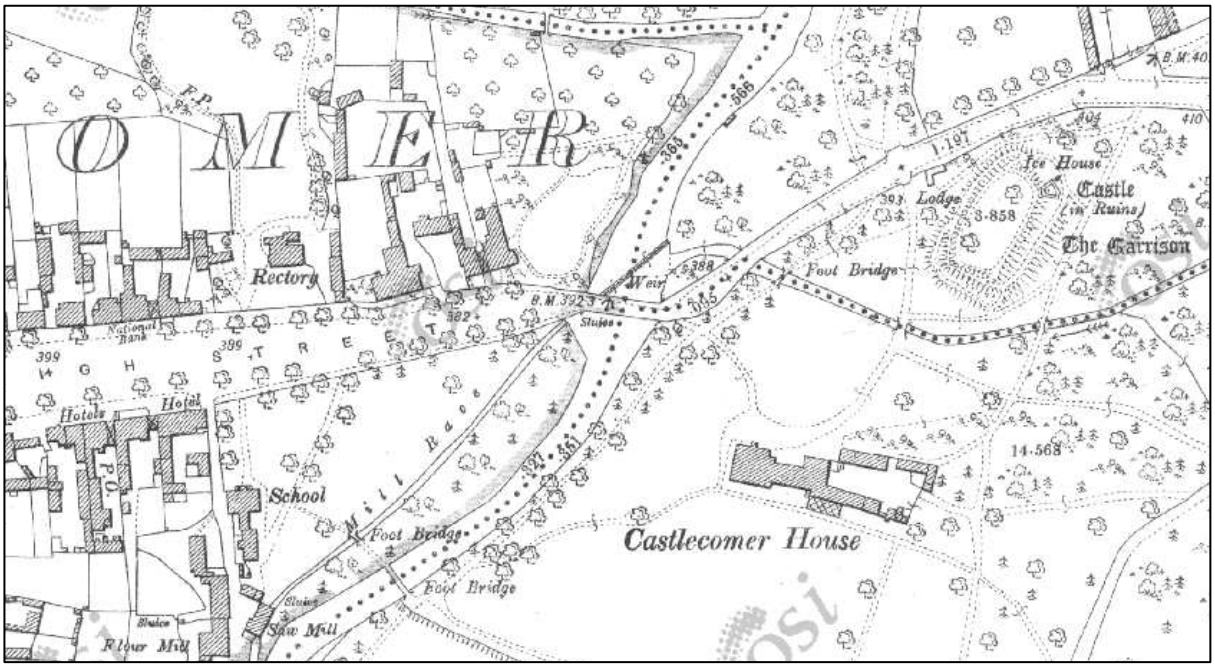


Figure 7: *Extract from the 25-inch edition Ordnance Survey map showing Castlecomer Bridge (Reproduced under Ordnance Survey Ireland Licence No. SU 0003319)*

The excavations database

The Excavation Database contains summary accounts of licensed archaeological investigations carried out in Ireland (North and South) and the relevant entries are presented in **Appendix 2**.

There are no entries for any licensed archaeological underwater surveys within the river channel and the most significance discovery in the area was a bastion fort uncovered at the Avalon Inn property within the town (Appendix 2; Licence 16E0631). This has been designated as a recorded archaeological site (KK005-104----) and is located approx. 150m to the west of the bridge.

Designated architectural heritage resource

The *Kilkenny County Development Plan* (2014-2012) and the *Draft Castlecomer Local Area Plan (2018-2024)* provide details on the protected structures within the county of Kilkenny and the town of Thomastown respectively. The bridge is listed as a Protected Structure (RPS D13) and a further 17 protected structures are also listed within the study area. These have been included in the NIAH which also lists an additional 11 buildings within the study area (**Table 2**). The majority of these designated structures are located within the streets of the town and none are located within 30m of the bridge structure (**Figure 3**). As previously noted, the bridge is located outside the Castlecomer ACA.

***Table 2**: Designated architectural heritage structures within study area*

NIAH Ref	*RPS No*	*Name*	*Townland*	*Structure Type*
12301001	D13	Castlecomer Bridge	Ardra, Castlecomer, Drumgoole	Bridge
12301002		-	Castlecomer	House 18th /19th century
12301003		-	Castlecomer	House 18th /19th century
12301004			Castlecomer	House 19th /20th century
12301005	C494	Avalon Inn Hotel	Castlecomer	House 18th /19th century
12301006		-	Castlecomer	Rectory 19th century
12301007		Orton House	Castlecomer	House 18th /19th century
12301008	C44	Bank of Ireland	Castlecomer	House 19th century
12301009	C45	Londis	Castlecomer	House 18th /19th century
12301010	C44	M Harrington	Castlecomer	House 18th /19th century
12301011	C47	-	Castlecomer	House 19th century
12301051	C48	The Lime Tree	Castlecomer	House 19th century
12301052	C53	The Lime Tree	Castlecomer	House 19th century
12301053	C54	-	Castlecomer	House 18th /19th century
12301054	C55	Holland Condon	Castlecomer	House 18th /19th century
12301055	C56	Moran's	Castlecomer	House 19th century
12301056	C56	McKenna	Castlecomer	House 19th century
12301057	C56	King's	Castlecomer	House 19th century
12301058	C497	Castlecomer Flour/Saw Mill	Castlecomer	Mill 18th /19th century
12301059	C490	Wandesford National School	Castlecomer	School 19th /20th century
12301060		-	Castlecomer	
12301061	C331	Castlecomer House	Ardra	Gate Lodge 20th Century
12301065	C66	-	Ardra	Gates & Piers 19th Century
12301080		-	Castlecomer	House 19th century
12301081	C509	Castlecomer House	Drumgoole	Gates & Piers 19th

NIAH Ref	*RPS No*	*Name*	*Townland*	*Structure Type*
12301085		Castlecomer House	Ardra	Icehouse 19th century
12301086		-	Ardra. Drumgoole	Bridge 19th century
12301088		Castlecomer House	Ardra. Drumgoole	Bridge 19th century

4. Description of the existing structure

The bridge was described in 2004/5 in the National Inventory of Architectural Heritage (NIAH) as follows;

> *Five-arch road bridge (with slight hump-back) over river, built 1763. ... (uncoursed rubble sandstone) walls centred on granite ashlar triangular cutwaters to piers having pyramidal capping [see **Plate 22**] with lichen-spotted cut-granite stringcourses supporting parapets having lichen-spotted cut-granite coping (several sections of which have been replaced with cast concrete). Series of five round or segmental arches between round-headed niches [see **Plate 20**] with rusticated granite ashlar crow stepped voussoirs centred on lichen-spotted cut-granite triple keystones [see **Plate 15**]. Sited spanning Dinin River with wooded banks to river.*

The bridge is situated perpendicular to the Dinin River with the N78 continuing at angles from each end of the crossing. The eastern-most archway actually extends north under the road which turns north-eastward at this side of the bridge and a galvanised security fence has been erected over the upstream opening of the effectively dry archway (***Plate 12***). All arch soffits on the bridge have been gunited with sand and cement from the cut granite springing of each arch to the outer edge of the arch intrados (***Plate 17***). A stone-built weir (***Plate 11***), originally constructed to take water for the nearby saw and flour mills is situated across the river on the north side of the bridge and directs water through the western archway to a separate mill race with a sluice gate for separating the mill race from the river (***Plate 19***). On the south, downstream side of the bridge, there are a number of steps (***Plate 18***) facilitating the change of levels from the partially stone-floored bed of the river beneath the bridge arches to the natural river bed further downstream of the widened channel around the crossing. Just north of the bridge, a small watercourse from the east joins the Dinin, passing beneath the N78 road through a pair of skewed three-centred archways (***Plate 24***).

The site of the proposed pedestrian bridge is on on the eastern side of Castlecomer town, County Kilkenny on the N78 crossing of the River Dinin bridge. The new structure will run-east west roughly adjacent to the existing bridge. and will not be attached to the structure. The new bridge structure comprises a two-span glulam bridge with a central in river pier. The overall length of the bridge is approximately 47m with the eastern and western spans measuring 19m and 28m respectively. It is anticipated that the central pier will be supported on a rectangular pilecap of 4 no. piles. The top of the pilecap will be set just below bed level of the river to ensure no impact on flow.

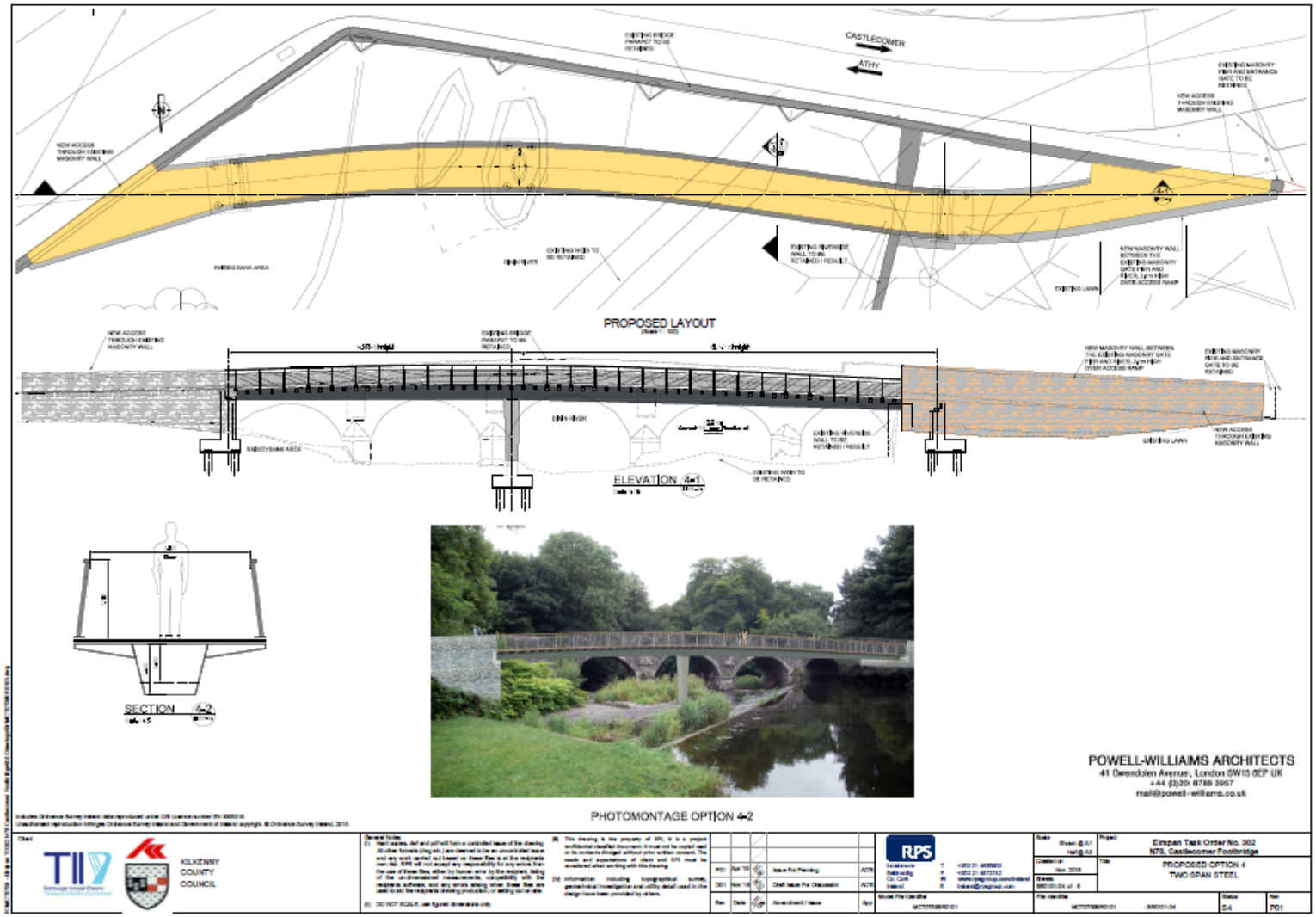


***Figure 7**: Scheme drawing of the proposed independent two-span glulam bridge*

5. Assessment of the proposed development

Archaeology

While there are no known archaeological monuments located on the direct footprint of the proposed project, research undertaken for this assessment revealed that existing bridge site and the environs of the river have been identified as part of a battlefield site (Monument Number KK005-102----). In addition, the subject site is also located within the wider environs of an earlier 1641 Confederate conflict centred on 'the Garrison' or castle located c. 155m to northwest of the subject site. The recent archaeological discovery of the remains a bastion fort (Monument Number KK005-104----) located 150m northwest of the current bridge and built to protect the river crossing in 17th century highlights the military and strategic significance of the bridge and its environs to the historical development of the town. Historical sources also attest to the presence of buildings destroyed during the 1790 battle on both sides of the bridge and sub-surface remains of these structures may survive. Riverine crossing areas also have the potential to contain the remains of earlier bridge or fording features as well as stray archaeological artefacts.

The potential, therefore, exists for the presence of features and artefacts associated with the battlefield site and other archaeological activity within the environs of the project area. Any ground disturbance works undertaken within the river channel and adjacent areas will have the potential to result in direct negative impacts on any such archaeological features should they be present.

Built heritage

The existing masonry bridge is of great significance to the built heritage of Castlecomer and it is included in the Record of Protected Structures (RPS Ref. no. D13) within the current *Kilkenny County Development Plan*. The bridge was rated as being of National importance in the National Inventory of Architectural Heritage (NIAH no. 12301001) survey of bridges and other historic structures in County Kilkenny. In developing proposals for a new footbridge, the designers have sought to a high-quality contemporary form that is clearly legible as a modern intervention. This approach is wholly consistent with the conservation principles espoused in the *Architectural Heritage Protection Guidelines* (2011) issued by the Department of Arts, Heritage and the Gaeltacht (now the Department of Culture, Heritage and the Gaeltacht) such as promoting minimum intervention (Section 7.7 of the guidelines), promoting honesty of repairs and alterations (Section 7.10 of the guidelines), ensuring reversibility of alterations (Section 7.12 of the guidelines) and avoiding incremental damage (Section 7.13).

Furthermore, the approach adopted by the design team corresponds with the most applicable development management standard for architectural conservation areas (ACA) outlined in Kilkenny County Council's County Development Plan, namely:

> *To encourage high quality, contemporary design and materials where appropriate when new buildings are being introduced into an ACA and the retention of the historic scale and plot size*

Notwithstanding the design approach that has been adopted, the proposed development will have a *slight negative impact* on the setting of Castlecomer Bridge however it will not give rise to direct impact on original fabric of note (as opposed to other design interventions that had been under the review during the design process.

While the proposed pedestrian bridge will not be attached to the existing bridge structure, sections of the western and eastern approach walls on the northern side of the bridge will have to be removed to create access to the new independent pedestrian bridge. On the northern side of the bridge, the section of masonry to be removed to facilitate the pedestrian connection is in relatively poor condition with a large concrete capping and it has likely been truncated to create present timber-sheeted gate which has stone-tiled concrete piers and appears to date from *c.*2000. Furthermore, this portion of walling is part of the boundary wall of No. 16 High Street as opposed to part of the masonry parapet of the bridge. This proposed intervention will result in a *direct, slight, negative impact* on the curtilage of No. 16 High Street (Protected Structure Ref. C491). East of the section to be removed, the existing wall will be reduced in height to allow for passive surveillance; the wall will be reduced to an earlier parapet height as defined by a row of vertical coping stones (see **Figure 8** below). This will result in a *neutral impact* as it will involve the removal of a portion of walling that is not original to the construction of the bridge.

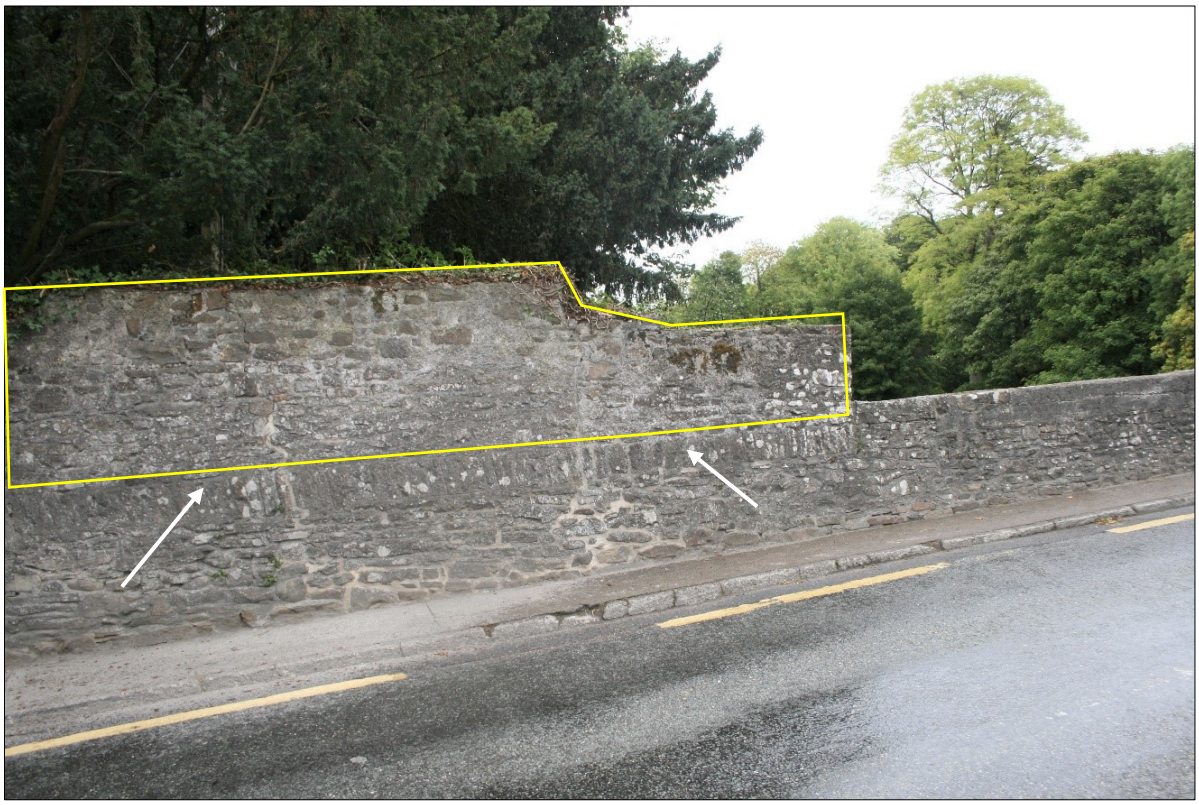


***Figure 8**: Section of walling to be removed outlined by yellow line; wall to be reduced to an earlier bridge parapet height as evidenced by the row of vertical coping stones (indicated by arrows).*

The proposed development of a two-span bridge with an intermediate support between abutments allows for a reduced structural depth which in turn reduces the visual footprint of the structure on elevation albeit the provision of the pier will impinge on the view of the pier of the

existing bridge. Therefore, the proposed visual impact on the existing bridge will be *negative* but *slight* in significance.

6. Mitigation measures

Archaeology

The proposed project will have *no predicted impacts* on any recorded archaeological sites. However, it is located within the *Zone of Notification* for the historic town of Castlecomer (KK005-082---) and forms part of the battlefield of a military engagement during the 1798 rebellion which has been designated as a recorded archaeological site (KK005-102----). In addition, a number of archaeological monuments within the wider area are connected with an earlier Confederate siege of Castlecomer in 1641. Finally, the proposed development works will include in channel works within the River Dinin which *may* have a direct negative impact on any previous unrecorded archaeological features, deposits or artefacts which have the potential to survive within the riverbed. The proposed project can therefore be considered to be located in an area of *moderate* to *high archaeological potential.* The following mitigation measures are proposed:

- It is recommended that an Underwater Archaeological Impact Assessment (UAIA) of the in-channel areas (including riverbanks) to be impacted by the proposed bridge structure should be carried out prior to the construction phase. This should include a dive/wading survey of the river channel licenced by the NMS.

- It is recommended that if any areas of ground on either side of the river bank will be impacted by ground works associated with the project such areas (if accessible) should be subject to pre-construction archaeological test trenching.

- Given the archaeological potential of the area, it is recommended that archaeological monitoring of all ground and in-channel excavation works should be carried out during the construction phase. This is particularly important on the eastern side of the riverbank within the raised bank area as this bank is effectively an island formed by the main river channel and a tributary channel.

- It is recommended that all phases of archaeological investigations should be augmented by the use of a metal-detector (under licence by the NMS) to assist in the recovery of archaeological artefacts.

- In the event that any archaeological features and/or artefacts are uncovered during any phase of site investigations, the NMS and the TII Project Archaeologist should be notified and consulted to determine appropriate further mitigation measures.

Built heritage

The proposed development will have a *slight negative impact* on the existing Castlecomer Bridge and its setting. The existing bridge is a protected structure included on the Record of Protected Structures (RPS Ref. no. D13) within the current *Kilkenny County Development Plan*. The bridge was rated as being of *National* importance in the National Inventory of Architectural Heritage (NIAH Reference: 12301001). Following examination of the various structures adjacent to the proposed river crossing, it is concluded that the proposed bridge will not have any significant effects on the designated architectural heritage resource other than the Castlecomer Bridge. The predicted impact relates to the alteration to the setting of the bridge and the removal of localised

sections of (a) a rubble parapet wall to the north-east of the bridge and (b) a section of street-frontage garden walling associated with No. 16 High Street; these interventions are required to facilitate connection to existing pavements from the new footbridge. The following mitigation measures have and will be adopted:

- Prior to commencement of works, a conservation method statement shall be prepared by a suitably qualified conservation consultant/architect to specify (a) works for the planned interventions so that the interface between historic masonry to be removed and retained will be effectively repaired and made good and (b) the form/design of the new wall for No. 16 High Street (which will abut the new footbridge) (to ensure that the new wall is built in a manner consistent in form and materials with adjoining masonry walls).

- Any proposed conservation or repair works will be (a) undertaken by a contractor with proven experience of the conservation and repair of historic masonry structures and (b) under supervision of a suitably qualified conservation consultant/architect. The appointed conservation consultant/architect shall carry out periodic inspections and will approve workmanship. At the discretion of the conservation consultant/architect, the contractor may be directed to prepare sample work for approval (such as repointing and sample masonry panels).

- At commencement of works and following removal of vegetation at the areas where the new pedestrian bridge is to connect with existing pavements, a photographic and drawn scaled record of the sections of walling to be removed will be undertaken by a suitably qualified built heritage specialist.

- All masonry removed during the course of works shall be retained by the contractor for the duration of works. The retained material will be reused, where practicable, for the planned programme of repairs and in a new walling. Samples of an additional masonry/stone required for the completion of the planned works shall be reviewed and approved by the appointed conservation consultant/architect.

Residual impacts

The application of the aforementioned mitigation measures will reduce impacts on archaeological and built heritage resources. In addition, the new footbridge has been designed to avoid any direct impacts on the fabric and architectural form of the existing protected bridge and the built heritage significance of Castlecomer.

The new footbridge is of a high-quality contemporary form and will be clearly legible as a modern intervention. This approach is consistent with the Planning Authority's policy in relation to new development within an Architectural Conservation Area (ACA); namely, to encourage high quality, contemporary design and materials when new buildings are being introduced into an ACA. Nevertheless, on completion the setting of both the bridge and the curtilage of No. 16 High Street will have been impacted to a *slight negative* degree.

7. References/sources

Published works

Carrigan, W. (1905) *The History and Antiquities of the Diocese of Ossory* 4 vols (Reprint Kilkenny 1981)

Cox, R. & Gould, M. (2003) *Ireland's Bridges*. Wolfhound Press

Department of Arts, Heritage and the Gaeltacht (2011) *Architectural Heritage Protection: Guidelines for planning authorities*. The Stationery Office, Dublin

Farrelly, J., O'Reilly, B., and Loughran, A. 1993 'Urban archaeological survey - county Kilkenny' (2 vols.). Unpublished report commissioned by the Office of Public Works, Dublin.

Kilkenny County Council (2014) *Kilkenny County Development Plan 2014-2020.* Planning Department, Kilkenny County Council

Lewis, S. (1837) *Topographical Dictionary of Ireland*. 2 Volumes, Lewis & Company, London

Musgrave, R (1802) *Memoirs of the Different Rebellions in Ireland*, Vol. 2

O'Drisceoil, C. (2016) 'Archaeological Assessment Report Avalon Inn, High Street, Castlecomer County Kilkenny' (Unpublished Duchas report)

O'Keeffe, P & Simington, T. (1991) *Irish Stone Bridges: History and Heritage*. Irish Academic Press

Orpen, G.H. 1909 Mottes and Norman castles in Ossory. *Journal of the Royal Society of Antiquaries of Ireland* 39, 313-42.

Proctor Flory, S. (1896) *Fragments of a Family History*

Internet resources

http://www.askaboutireland.ie/griffith-valuation/

https://dcenr.maps.arcgis.com/apps/webappviewer/index.html

http://www.excavations.ie/

http://www.geohive.ie/

http://gis.teagasc.ie/soils/map.php

https://heritagemaps.ie/WebApps/HeritageMaps/index.html

http://landedestates.nuigalway.ie:8080/LandedEstates/jsp/index.jsp

https://www.logainm.ie/en/

8. List of appendices

Appendix 1: Photographic Record

Appendix 2: Recorded Datasets

Appendix 1: Photographic record

***Plate 1**: Western approach to Castlecomer Bridge from N78 High Street.*

***Plate 2**: View over road deck from south-west corner*

***Plate 3**: Detail of interior of north parapet wall*

***Plate 4**: Detail of interior of south parapet wall*

***Plate 5**: Approach to bridge from east with some ongoing damage to deck surface above springing point above east-most pier.*

***Plate 6**: View along south elevation from south parapet at west end.*

***Plate 7**: Localised deep-rooting vegetation on parapet exterior being kept trimmed back to restrict its development until it can be fully removed and affected masonry repaired.*

***Plate 8**: View along north elevation from north parapet at east end*

***Plate 9**: West abutment from north parapet.*

***Plate 10**: North elevation from Dineen River bed with weir to right of photograph which is centred on central arch of bridge.*

***Plate 11**: West half of north elevation with stone weir in foreground.*

***Plate 12**: East half of north elevation*

***Plate 13**: North opening of central archway*

***Plate 14**: Detail of north elevation of spandrel and 2nd pier from west abutment*

***Plate 15**: Keystone, voussoirs, string course and exterior parapet detail over 2nd arch from west abutment*

***Plate 16**: Pier closest to west abutment. Weir in foreground*

***Plate 17**: West shoulder of arch soffit within 2nd arch from west abutment. Limited moisture ingress from bridge deck is escaping through pier masonry and also through cracks in gunited arch soffit.*

***Plate 18**: South elevation*

***Plate 19**: Sluice at west end of south downstream side of bridge.*

***Plate 20**: South elevation of central archway*

***Plate 21**: Detail of spandrel over 2nd pier from east abutment. Parapet here was partially reconstructed with concrete blocks sometime within last 30 years*

***Plate 22**: Detail of downstream cutwater on south elevation*

***Plate 23**: Detail of downstream cutwater cap (on south elevation). Inappropriate cement pointing here and over all elevations poses a long-term risk to the proper performance of masonry.*

***Plate 24**: North-west openings of skewed archways carrying N78 over watercourse approximately 50m east of main bridge structure. The base of the new footbridge is to be positioned to the west*

Plate 23: *View of section of low walling to be removed on the approach/wing wall to the north-east of the existing bridge to facilitate eastern end of proposed new pedestrian bridge (Source: Google Streetview)*

Plate 26: *Extent of proposed new opening in masonry wall to accommodate western end of pedestrian bridge – the westernmost wall section is largely rebuilt and incorporates a portion of cast-concrete capping*

Plate 27: *View to north-west to area of garden (of No. 16 High Street) behind opening to be created in west end of north parapet wall. No structure evident behind this raised section of masonry.*

Appendix 2: Recorded datasets

Archaeological excavations within study area

At total of seven programmes of licenced archaeological investigations have been undertaken within the environs of Castlecomer town and the following summaries of the results have been published in the Excavations Database (www.excavations.ie)

Site Name	*Licence*	*Summary*
Ardra	-	A stone slab was dislodged in the course of laying a Telecom cable trench revealing a cist slightly trapezoidal in plan, wider at the east end. It consisted of 4 principal side-stones set on edge, leaning inwards. On all sides a series of packing stones were visible. The covering stone – a large triangular shaped slab – lay directly on these. The cist itself measured 1m in length and 0.5m in width at the base. The long bones which had been removed were, according to the finder, lying parallel to one another close to the northern edge of the grave. The jaw bone had been removed and replaced but lay originally in the centre of the cist Portions of human long bones were visible in various parts of the cist. Excavation soon revealed that the bone was in a poor state of preservation and that the burial had been placed in a disarticulated position. Fragments of the skull were found at the eastern end of the cist. There was no trace of a vessel or other accompanying objects. The floor of the cist consisted of a very fine grey sandy gravel and the bones lay directly on this.
Ardra, Clogh Road, Castlecomer	08E0762	An assessment was carried out in a greenfield site at Ardra, Clogh Road, Castlecomer, Co. Kilkenny, measuring 220m by 190m east–west and located to the north of Castlecomer town. Eighteen test-trenches were mechanically excavated to a depth of c. 0.65m across the proposed development site. Two areas (A and B) were extended to establish nature and extent of two deposits. In Area A, within Trench 6, one small deposit was recorded. An area of 8m2 was opened and no other features were found associated with this deposit. In Area B, within Trench 18, two shallow burnt spreads were exposed towards the southern end of the trench, measuring 1.8 long, 1m wide and 0.03m deep and 2m long, 1.2m wide and 0.04m deep respectively. This area was extended 8m west and 10m north and south; due to the presence of two water services crossing the proposed development this area was not extended to the east. These features appear to be modern in origin, although this was not definitely confirmed due to limitations as a result of the presence of water services. The full nature and extent of these spreads can be recorded during monitoring of topsoil-stripping in advance of or as part of the construction programme.
Ballyhimmin	08E0316	It was proposed to redevelop a greenfield site at Ballyhimmin, Castlecomer, with a shop and store building, bulk stores as well as ancillary facilities including signage, drainage, car-parking, landscaping and associated siteworks. Five trenches each over 200m long were excavated to give comprehensive site coverage. Trenches 1 to 4 were excavated on the level ground above the river valley, while Trench 5 was excavated between the foot of a steep hill and the bank of the River Deen. The entire field had been subject to regular deep ploughing and large quantities of fieldstone are dumped above the steep-sided slope of the river valley. A ridge of stony gravel was apparent in the ploughed soil prior to the testing. No finds or features of archaeological significance were uncovered in the course of the testing.
Castlecomer	07E1145	A small-scale test excavation was undertaken at a proposed development site on Main Street, Castlecomer. A single test-trench was excavated to

Site Name	*Licence*	*Summary*
		the rear of an existing premises. A single feature of archaeological significance was exposed during the excavation. A disused box drain, following a north-east/south-west orientation, was identified across the northern section of the trench c. 2–3m from its northern terminus. The drain consisted of two courses of limestone spaced 0.3m apart and at a depth of 0.15–0.3m below the natural clay surface. The base of the drain was unlined and cut directly out of the natural clay. The interior of the drain was filled with a grey/black silty deposit with no inclusions. No artefacts were recovered from the excavated section of the drain.
The Avalon Inn, Castlecomer	16E0183	A series of test excavations were undertaken in advance of proposed renovations and an extension to The Avalon Inn, Castlecomer, Co. Kilkenny. The development was located within the area of constraint for KK005-082, the historic town of Castlecomer. It was also located close to KK005-102 – Battlefield, c. 214m north-west of KK005-081 – House 16th/17th Century and c. 381m west of KK005-033001-002 – Motte and Castle. The desk study of the development area indicated that the current Avalon Inn building was built around the year 1800, on the site of an earlier house and gardens, possibly destroyed during the 1798 uprising. The area within which the proposed development lies was therefore considered to be an area of high archaeological potential. This was confirmed during test excavations, which revealed a total of nine potential archaeological features across the proposed development area. This included evidence of a demolished house to the east of the current Avalon Inn building (Feature 9), some previously demolished outbuildings of uncertain date (Features 3, 6, 8), a stone- and brick-lined culvert (Feature 1), cobbled yard surfaces (Feature 5 and Feature 7), and a large garden feature (Feature 2). No finds predating the post-medieval period were uncovered from the cleanback of the above features. The findings suggest that substantial remains of the foundations of a demolished house survive below ground to the south-east of the development area. It is possible that these represent the remains of an earlier house destroyed during the 1798 rebellion. To the rear of the current Avalon Inn building, evidence was uncovered of demolished outbuildings, culverts, yard surfaces and a garden feature, which were most likely associated with the existing early 19th-century building. However it may also be possible that some of these features were associated with the earlier house at this site.
Avalon Inn, Castlecomer	16E0631	A programme of excavation and further testing, in advance of permitted renovations and an extension to The Avalon Inn, Castlecomer County Kilkenny, was carried out in May 2017. A desk study of the development area indicated that the current Avalon Inn building was built around the year 1800, on the site of an earlier house and gardens, possibly destroyed during the 1798 uprising. The area was therefore considered to be an area of high archaeological potential. This was confirmed during a previous programme of test excavations, carried out by the author in 2016, which revealed a total of nine potential archaeological features across the entirety of the permitted development area. Features uncovered included evidence of a demolished house to the east of the current Avalon Inn building (Feature 9), some previously demolished outbuildings of uncertain date (Feature 3, 6, 8), a stone- and brick-lined culvert (Feature 1), cobbled yard surfaces (Feature 5 and Feature 7), and a large garden feature (Feature 2). No finds predating c.1700 were uncovered from the cleanback of the above features. The findings suggested that substantial remains of the foundations of a demolished house survived below ground to the south-east of the development area. It was deemed possible that these represent the remains of an earlier house that had been destroyed during the 1798 rebellion. To the rear of the current Avalon Inn building, evidence was uncovered of demolished outbuildings, culverts, yard surfaces and a garden feature,

Site Name	Licence	Summary
		which were most likely associated with the existing early 19th-century building. However it may also be possible that some of these features were associated with the earlier house at this site. These excavations suggested that the subsurface remains of the demolished house (Feature 9), that predated the current Avalon Inn building, were largely destroyed by a series of modern pipe trenches and concrete foundations. While the exact relationship between the structure and the current Avalon Inn building could not be ascertained, it is still likely that the surviving features represented the remains of the earlier house, possibly the one destroyed during the 1798 rebellion. To the rear of the Avalon Inn building, further evidence was uncovered of demolished structures predating the most recent rear extension to the Avalon Inn. One of these walls (Feature 19) appeared to follow the line of a wall projecting from the north side of the early-19th-century building and are therefore likely to date from the same phase of construction or later. The possibility still exists however that some of these features were associated with the earlier house at this site. To the north of the development area, test excavations revealed a series of intact garden horizons and probable garden features (Features 11, 12, 13, 14, 15 and 16). These features consisted of several possible planting beds as well as some internal dividing walls. While a garden is shown at this location on the first edition OS map (1838), no walls are depicted on it or any subsequent editions. It is possible that these garden features therefore predate the 1838 map and relate to the Georgian/early Victorian house that formerly stood on the site.
Market Square, Castlecomer	01E1203	Kilkenny County Council requested that a pre-development assessment should be undertaken in advance of the erection of an extension to a fruit and vegetable shop. The site lay within the zone of archaeological potential as outlined in the Urban Archaeology Survey of Castlecomer. The square and its surrounding streetscape were developed in the 17th century by Lord Wandsford. Five test-trenches were opened by hand in the area of the proposed development. Nothing of archaeological significance was uncovered.

Archaeological Survey of Ireland (ASI) site descriptions

The following table presents the available Archaeological Survey of Ireland inventory descriptions of the recorded archaeological monuments within the study area (source: www.archaeology.ie).

Monument No.	Type	Townland	Description
KK005-033001-	*Castle unclassified*	*Ardra*	In the grounds of Castlecomer House, on elevated ground lying at the confluence of the Dinin River, c. 120m to the W, with a tributary river immediately to the S, to the E of Castlecomer. Orpen (1909, 318-19) writes that, 'From an entry in the Liber Primus of Kilkenny it appears that a castle of some sort was erected here prior to the year 1200, as it is said to have been burned in that year by the O'Brenans'. He goes on to add that, 'just before the death of the younger William Marshal in 1231, he obtained a grant for forty days of his service due to the king to enable him "to fortify his castle of Cumbre [Castlecomer]"' (ibid.). In 1295, Edward I gave the custody of the castle of Combre to Richard le Erecedekne [Archdeacon], to fight the enemies of the king. The first actual mention I have noted of a [stone] castle here was in 1289' (ibid.). Both Carrigan (1905, vol. 2, 159) and Orpen (1909, 319) mention that the castle which

Monument No.	Type	Townland	Description
			stood on the motte, or the 'Garrison', was besieged by the Confederate army in 1641 for over three months. Carrigan adds that it,'has been entirely demolished'. The motte is heavily overgrown with trees and there is no visible trace of a stone medieval castle on the top. The only upstanding building is an angled structure (KK005-033003-) at the NE end which possibly dates to the 17th century and this seems to be the 'Castle (in Ruins)' indicated on the 1899 revision of the 6-inch OS map (Farrelly, O'Reilly and Loughran 1993, 127).
KK005-033002-	*Castle - motte*	*Ardra*	In the grounds of Castlecomer House, on elevated ground lying at the confluence of the Dinin River, c. 120m to the W, with a tributary river immediately to the S, to the E of Castlecomer. Orpen (1909, 318-19) writes that, 'From an entry in the Liber Primus of Kilkenny it appears that a castle of some sort was erected here prior to the year 1200, as it is said to have been burned in that year by the O'Brenans'. He goes on to add that, 'just before the death of the younger William Marshal in 1231, he obtained a grant for forty days of his service due to the king to enable him "to fortify his castle of Cumbre [Castlecomer]"' (ibid.). In 1295, Edward I gave the custody of the castle of Combre to Richard le Erecedekne [Archdeacon], to fight the enemies of the king' (ibid.). The monument is heavily overgrown with trees. Carrigan (1905, 157), describes it as being, 'about 25ft. [7.62m] high, and flat at the top, where it is 60 [54.86m] yards long and 30 [27.43m] yards wide'. Orpen (1909, 319), states that the 'original earthen defences, which we may presume once surrounded the mote, have been obliterated by public road and private avenue, and the mound itself is traversed by modern paths, and obscured by trees and shrubs'. There is no visible trace at ground level of the medieval castle (KK005-033001-) which probably stood on top of the motte. At the NE end of the top of the motte there is an angled structure (KK005-033003-) which possibly dates to the 17th century. Built into the base of the motte at the NE is an icehouse associated with Castlecomer House c. 170m to the SW (Farrelly, O'Reilly and Loughran 1993, vol. 1, 127)..
KK005-033003-	*Bastioned fort*	*Ardra*	No description available
KK005-057----	*Redundant record*	*Drumgoole*	In 1955, during land clearance works on the Wandesforde estate, old walls were covered. Following an inspection (OPW files, 21 November 1955), it was reported that, the 'walls turned out to be embanking walls on either side of the stream which flows through the demesne, running between Castlecomer House [KK005-081----] and the mote [KK003-033002-]. The stream brought down so much silt that it narrowed its bed and these walls were rendered unnecessary and the upper parts removed and the remaining parts sodded over and hidden from view until rediscovered in the last few months. The walls are of smallish, flat stones of about 2' [0.6m] thick. They bear no relation to the mote, as far as can be ascertained', the report goes on to say that an 18th-century date is the more probable for work of this kind. The evidence does not warrant their inclusion as an archaeological monument.
KK005-081----	*House - 16th/17th century*	*Drumgoole*	In 1635 Castlecomer was granted to Christopher Wandesforde, who established a town there and in 1638 built Castlecomer House. However, according to Nolan (1979, 78, 112), the family did not establish their principal residence here until c. 1694. Castlecomer House was burned down in 1798 during the Battle of Castlecomer (http://archiseek.com/2014/1802-castlecomer-house-co-kilkenny/, viewed 12 June 2017). In 1802 Lady Anne Ormonde rebuilt the house (ibid.). According to Bence-Jones (1988, 64), this house dated to the 18th and 19th

Monument No.	*Type*	*Townland*	*Description*
			centuries. Castlecomer House lay vacant during the 1960s and into the 1970s until it was almost completely demolished in 1975 (http://archiseek.com/2014/1802-castlecomer-house-co-kilkenny/, viewed 12 June 2017). In 1979 a two-storey house was built on part of the site (Farrelly et al. 1993, 128).
KK005-082----	*Historic town*	*Castlecomer*	No description available

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