From the office of the Minister for Infrastructure
LIZ KIMMINS MLA

Department for Infrastructure
An Roinn Bonneagair
Depairtment fur Infrastructure
www.infrastructure-ni.gov.uk

Eoin Tennyson MLA
eoin.tennyson@mla.niassembly.gov.uk

Private Office, 3rd Floor,
James House, Gasworks Site,
2 - 4 Cromac Avenue,
Belfast, BT7 2JA
Telephone: (028) 9054 0540
Email: Private.office@infrastructure-ni.gov.uk

Date: 20 January 2026

Eoin, a chara,

AQW 37885/22-27

A redacted version of the Bannfoot footbridge feasibility study is deposited in the Assembly Library.

Should there be any follow on queries concerning the Deposited Report, you can contact my officials in the Active Travel Unit by email: activetravel@infrastructure-ni.gov.uk.

LIZ KIMMINS MLA
Minister for Infrastructure

26/01/2026

Feasibility Report

Bannfoot Bridge Feasibility Study

402126-AMEY-00-XX-RP-C-00001

Revision P01

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Executive Summary

DFI Roads (Southern Division) have commissioned DFI Consultancy Services and its partner Amey Consulting to undertake a feasibility study on the provision of a bridge over the River Bann close to Bannfoot on the southern shores of Lough Neagh in County Armagh. A bridge at this location would connect the C0160 Bannfoot Road approaching the eastern bank of the River Bann to the C0160 Columbkille Road approaching the western bank, spanning approximately 40m.

In the past a hand operated ferry completed the passage across the River Bann and linked the communities of Maghery and Columbkille on the West side to the Bannfoot and Derrystrasna communities on the Eastern side. The lack of a link at this location results in a c.16-mile diversion for motorised vehicles via the M1 Motorway and a c.18-mile diversion for non-motorway traffic, including cyclists and pedestrians.

This feasibility study assesses the following three solutions at this location, to enable a comparison to be made on suitability of structure and approximate cost:

Option 1 - Pedestrian/cycle bridge

Option 2 - Road bridge

Option 3 - No bridge

Option 1 comprises a single-span pedestrian/cycle bridge with a deck width of 4m between parapets to accommodate shared pedestrian and cyclist use, with a white line and/or contrasting surface provided for segregation of pedestrian and cycling traffic. A 2.5m wide cycle path and 1.5m wide footpath would be provided as per CD 353 Table 11.7. The bridge would cross the river at the termination point of the two existing roads, with a clear span of approximately 40m and no skew.

3 No. pedestrian/cycle bridge sub-options have been considered in this report, each with a different superstructure structural form as presented below:

i. Warren truss

ii. Tied arch

iii. Butterfly arch

With the available ground information at this stage, it is assumed that the substructure for each option would comprise reinforced concrete bored piled abutments with a reinforced concrete capping beam. The substructure would be supported on bearings at each abutment.

Option 2 comprises a single-span integral road bridge with deck width of 9m to accommodate a 6m wide 2-lane carriageway, 2 No. 1m wide footpaths and 2 No. 0.5m wide parapet stringcourses. The bridge would cross the river approximately 50m south of the termination point of the two existing roads, with a clear span of approximately 52m and 7^{o} skew.

Option 1 is the preferred option to cross the River Bann at Bannfoot. The cost of a pedestrian/cycle bridge is significantly lower than for a road bridge as well as being the less intrusive, more aesthetically pleasing bridge option in this rural and scenic environment. This option also has a significantly lower carbon footprint and presents benefits in terms of reduced land take and reduced impact on the nearby property. Given the analysis undertaken, the rural location, class of road approaching the site and the relatively small numbers that would regularly use a road bridge, the benefits offered by the road bridge do not outweigh the benefits offered by the pedestrian/cycle bridge, particularly the cost and carbon savings.

Of the three pedestrian/cycle bridge sub-options, the tied arch option is preferred as it is deemed to be aesthetically pleasing, providing a modern and iconic structure that will help bring more pedestrians and cyclists to the area, whilst being slightly less expensive than the butterfly arch option.

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1. Project Information

1.1. Introduction

1.1.1 Scheme Overview

DFI Roads (Southern Division) have commissioned DFI Consultancy Services and its partner Amey Consulting to undertake a feasibility study on the provision of a bridge over the River Bann close to Bannfoot, on the southern shores of Lough Neagh in County Armagh. A bridge at this location would connect the C0160 Bannfoot Road approaching the eastern bank of the River Bann to the C0160 Columbkille Road approaching the western bank, spanning approximately 40m.

In the past a hand operated Ferry completed the passage across the River Bann and linked the communities of Maghery and Columbkille on the West side to the Bannfoot and Derrystrasna communities on the Eastern side. The lack of a link at this location results in a 16-mile diversion for motorised vehicles via the M1 Motorway and an 18-mile diversion for non-motorised users, not permitted on the motorway.

This feasibility study assesses the following three solutions at this location, to enable a comparison to be made on suitability of structure and approximate cost:

Option 1 - Pedestrian/cycle bridge

Option 2 - Road bridge

Option 3 - No bridge

Figure 1-1: Site Location (Image from Google Maps)

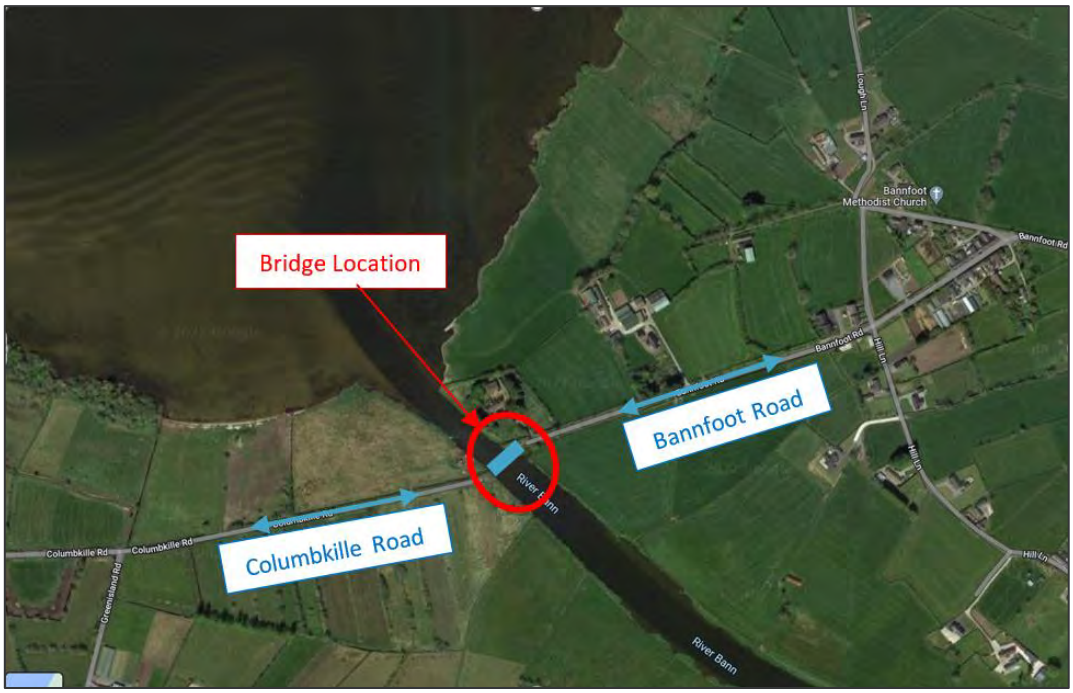

Figure 1-2: Approximate Bridge Location – Plan View (Image from Google Maps)

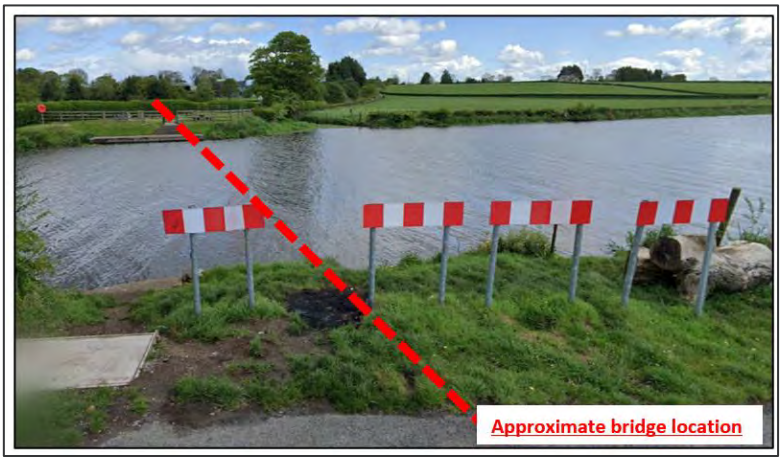

Figure 1-3: Approximate Bridge Location – View from Columbkille Road (Image from Google Maps)

1.1.2 Option Appraisal Criteria

Criteria used to appraise each option within this report include:

- Capital cost and whole life cost;
- Aesthetics;
- Durability and operation / maintenance;
- Buildability;
- Function;
- Highway works;
- Lands;

- Geotechnical;
- Environmental;
- Carbon footprint.

1.1.3 Requirement for Structure

There is currently no link between the C0160 Columbkille Road (approaching the west bank) and C0160 Bannfoot Road (approaching the east bank), which are separated by the River Bann. The last 30m of the Bannfoot Road is currently fenced off and has been converted to an amenity area by the Armagh City, Banbridge & Craigavon Borough Council (ABC Council), with picnic benches and stepped access to a small quay and the river. On the west approach the final 500m of Columbkille Road has fallen into a significant disrepair state, however there is a small quay and bench at the water's edge. A project constraints map has been included in Appendix A-1 for information.

This report seeks to identify the need and suitability for the provision of a bridge the River Bann to provide a link between the Columbkille Road and Bannfoot Road. Options for pedestrian/cycle bridges and a road bridge are presented in this report, with clear spans varying from 40m to 52m and deck widths varying from 4m to 9m. Further information on the proposed geometry and structural form of each bridge option is provided in Sections 1.4 and 2.1.

Figure 1-4: Existing Amenities at Eastern Approach (End of Bannfoot Road)

Figure 1-5: Road in Poor Condition at Western Approach (End of Columbkille Road)

1.1.4 Infrastructure Links

Vehicular Traffic

To the East of the River Bann:

Vehicular traffic on Bannfoot Road is extremely low provided it is currently utilised for accessing the land and properties adjacent and to access the picnic area and river edge only. On the day of the project team's site visit on the afternoon of the 25th October 2022 no vehicles were observed on the stretch of carriageway between the water's edge and the junction with Hill Lane.

The small village of Bannfoot is situated approximately 500m to the east of the River Bann and mostly residential, with no designated shopping street, but with additional housing developments currently under construction.

Further east lies the villages / townlands of Derrytrashna, Derrymacash, Derryadd and Aghacommon before the larger towns of Lurgan, Craigavon and Portadown are reached. Potential trip generators to the east of the Bann between Lough Neagh and the M1, with the potential to bring people from further afield to the area include:

- Wolfe Tone GAC
- Several small independent businesses within Derrymacash
- Ardmore Church
- My Dog's Best Friend NI
- Bellville Presbyterian Church
- Bayshore Sports & Social Club
- Norman Emerson Group
- St Mary's Primary School, Derrymacash
- Derrytrashna Playgroup
- Sarsfield GFC
- Foxberry Fruit Farm, Derrytrashna
- Bannfoot Methodist Church

Access to the M1 can be achieved via junction 10 to the north of Lurgan or via Aghacommon and the M12 at junction 11 to the north of Craigavon.

To the West of the River Bann:

It is assumed that vehicular traffic on Columkille Road between its junction with Greenisland Road and the waters edge is extremely low and for access to the adjacent land by the farmers and occasional access to the small jetty to the north of the proposed bridge site. No vehicles were observed on this carriageway during the project team's site visit on the afternoon of 25th October 2022.

The small village and townland of Maghery is situated approximately 3.6km to the west of the River Bann, via the Columbkille Road and Maghery Road. Potential trip generators to the west of the Bann include:

- Fox's Garden Nursery

- Forker Garden Products
- Maghery GAC
- Maghery Country Park
- St Mary's Primary School, Maghery
- Church of Our Lady Queen of Peace
- Church of St Mary
- Milltown Parish Church of Ireland

The M1 can be accessed via the Birches Roundabout at J12 via the Columbkille Rd and B196.

Necessary Diversion due to no ferry / bridge for motorised vehicles

In the past there was a small, hand-operated ferry which operated across the River Bann at this location, meaning vehicles, cyclists and pedestrians could travel from east to west and vice versa directly. Since this service was removed in 1979, the additional journey distances and associated delays are detailed below, for vehicles able to utilise the M1. The main diversion routes are shown on drawing 402126-AMEY-00-XX-DR-C-00002 – Necessary Diversion Routes, included within Appendix A.

Table 1-1 - Approximate diversion routes for motorised vehicles

From	To	Via	Without bridge		With bridge		Consequential delay (km / mins)
			Dist. (km)	Approx. journey time (mins)	Dist. (km)	Approx. journey time (mins)	
Maghery	Bannfoot	B196, M1, Charlestown Road, Bannfoot Rd	25.7	23	4.3	6	21.4 / 17
	Derrytrasna		22.5	20	6.9	9	15.6 / 11
	Derrymacash		20.9	18	12.2	15	8.7 / 3
	Aghacommon		18.8	18	14.0	17	4.8 / 1
Maghery	Lurgan	M1	20.3	18	18.7	23	1.6 / 5
Bannfoot	Maghery	Charlestown Rd, M1, B196	25.9	25	4.3	6	21.6 / 19
Bannfoot	Portadown	Charlestown Rd, A3	15.8	18	14.3	15	1.5 / 3

Non-motorised Users

Non-motorised traffic in the area is subject to a diversion of approximately 18 miles (estimated to take in excess of 1hr 30mins for cyclists) via Portadown as depicted on drawing 402126-AMEY-00-XX-DR-C-00002 – Necessary Diversion Routes in Appendix A.

Sustrans Loughshore Trail

The Sustans Loughshore Trail is a "*mostly level 113 mile circuit of Lough Neagh… on quiet, virtually traffic-free minor roads and lanes with short stretches of traffic free path.*" (Sustrans, 2023). Due to the lack of link across the River Bann at Bannfoot, the route is required to divert away from the shores of Lough Neagh towards Portadown. A pedestrian/cycle bridge across the River Bann at Bannfoot would remove the current diversion into Portadown along the existing Loughshore cycle trail and create a continuous cycle route around Lough Neagh, awarding cyclists with a scenic quiet link along the southern shores through County Armagh countryside. The existing Loughshore route in its entirety is depicted in Figure 1-6 and a potential link made possible through provision of a suitable bridge is shown in Figure 1-7 (shown indicatively only).

Figure 1-6: Map depicting Loughshore Trail (Sustrans, 2023)

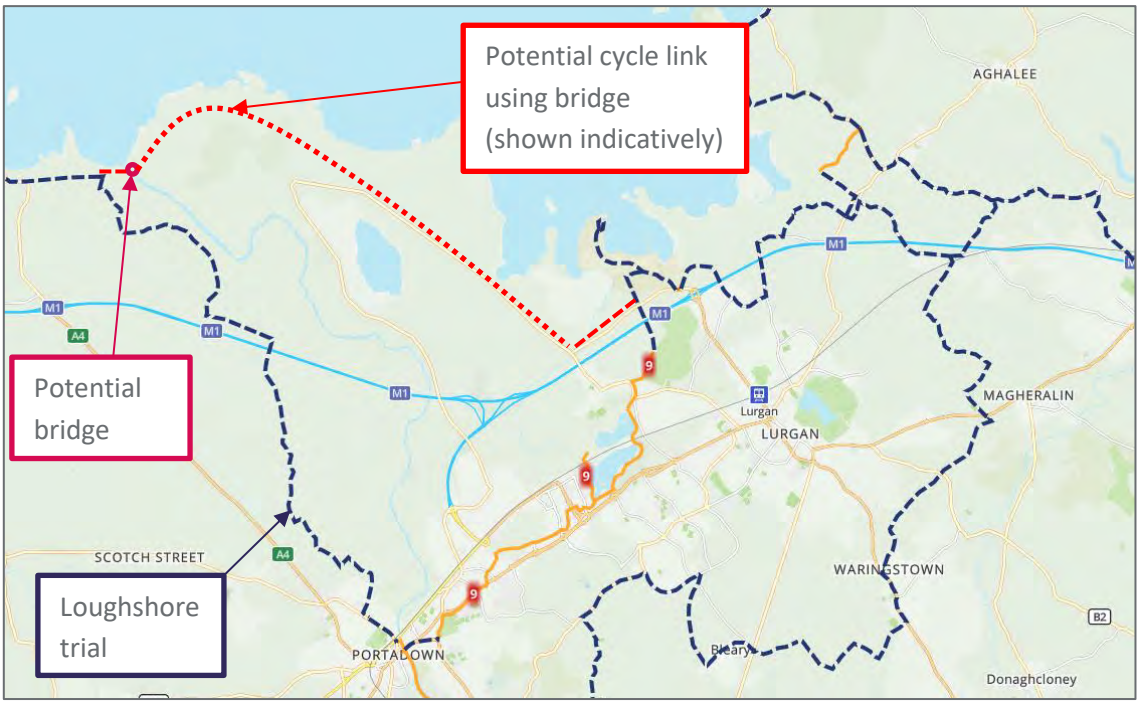

Figure 1-7: Map depicting Loughshore Trail (Sustrans, 2023)

1.2. Consultations and Requirements

1.2.1 Consultations

There has been no stakeholder consultation undertaken to date. Any required consultations will be undertaken at the next stage of this project.

1.2.2 Statutory Services

C2 service enquiries in line with NIRAUC were submitted to the providers outlined in the table below to determine what equipment and apparatus are on the approach roads and in the vicinity of the proposed bridge location (information provided by each service provider is available in Appendix C). Each response is summarised below, alongside the anticipated impact on proposals:

Service provider	Apparatus within scheme extents?	Details	Anticipated impact on proposals
Atkins (Vodafone)	No apparatus	-	-
Openreach	Yes Located on Bannfoot Rd	Overhead line	Minimal impact on proposals. Underground be affected depending on the extent of resurfacing on the Bannfoot Road.
Virgin Media	No apparatus	-	-
Eircom	No apparatus	-	-
Fibrus	Yes Located on Bannfoot Rd	Overhead line	Minimal impact on proposals
Firmus Gas	No apparatus	-	-
Northern Ireland Water	Yes Located on Bannfoot Rd	Underground watermain	Minimal impact on proposals. May be affected depending on the extent of the resurfacing works on Bannfoot Rd. Watermain may also be affected by the road bridge option as it clashes with the proposals for the approach ramp on Bannfoot Rd.
Northern Ireland Electricity	Yes Located on Bannfoot Rd	Overhead line	Minimal impact on proposals
DFI Rivers	Yes	River Bann flowing towards Lough Neagh	N/A
DFI Roads (Streetlighting & drainage)	No apparatus		

Further consultation with the service providers with apparatus within the scheme extents should be undertaken during the future project stages to confirm their requirements, including any potential required diversions.

1.3. Preliminary Geotechnical Engineering Assessment

1.3.1 Recorded Ground Conditions

This section presents a preliminary ground engineering assessment of the bridge options considered in this report. It should be noted that the soil strata depths assessed for the ground models and ground conditions are based on relevant historic exploratory holes (GSNI Ref No.: BH01/1989 & BH02/1989 and published geological mapping. Historic exploratory holes were carried out to facilitate the installation of a pipe beneath the River Bann in 1989.

Published Geology

The Geological Survey of Northern Ireland (GSNI) published 1:10k geology maps have been reviewed with extracts of the geological mapping provided in Figures 1-8 and 1-9.

Superficial Geology

The site is predominantly underlain by superficial alluvium deposits. To the north of the site extents, lacustrine beach deposits are recorded on the southern perimeter of Lough Neagh. Glaciofluvial ice contact soils are located approximately 100m to the east of the site and organic peat material is located approximately 140m west of the site. Areas of glacial till deposits are recorded surrounding the site. Figure 1-8 shows the 1:10k Superficial Geology map extracted from the GSNI GeoIndex.

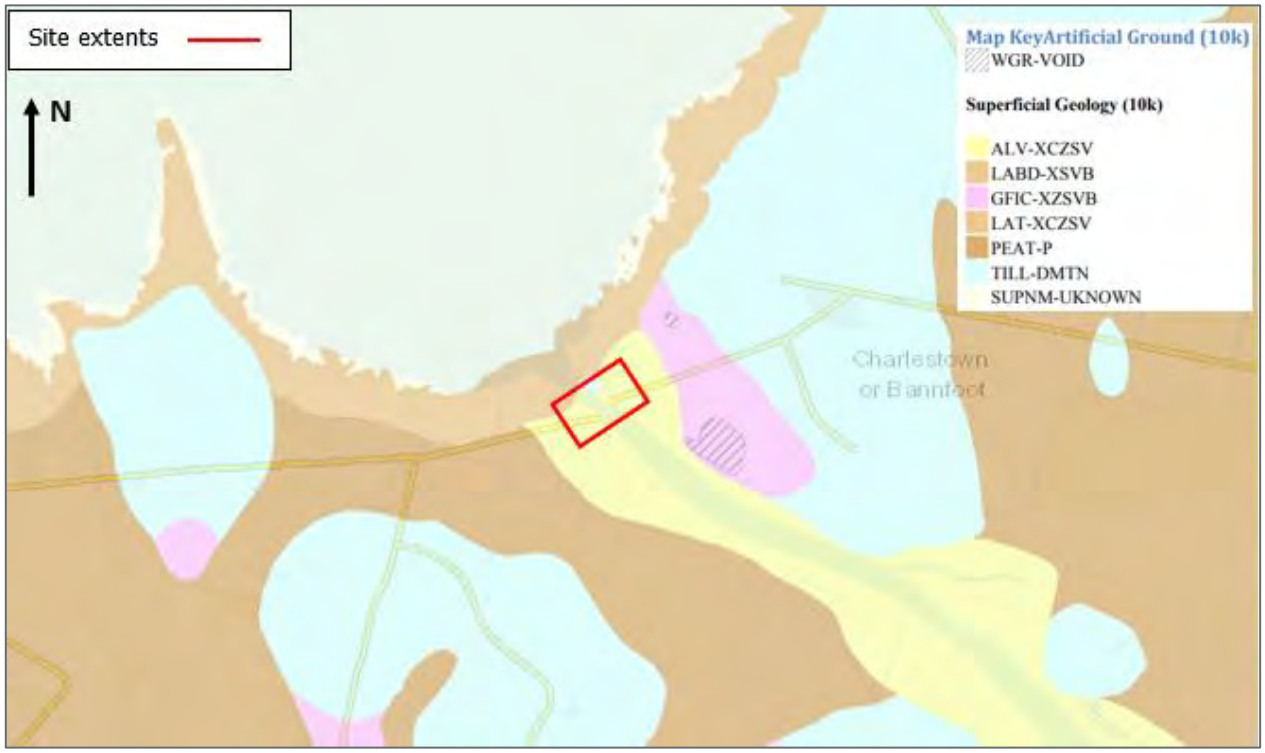

Figure *1-8*: Superficial Geology Map and Artificial Ground (GSNI GeoIndex)

Bedrock Geology

The site is recorded to be completely underlain by Lough Neagh Clays – Clay and Lignite. Figure 1-9 presents the 1:10k Bedrock Geology map extracted from GSNI data.

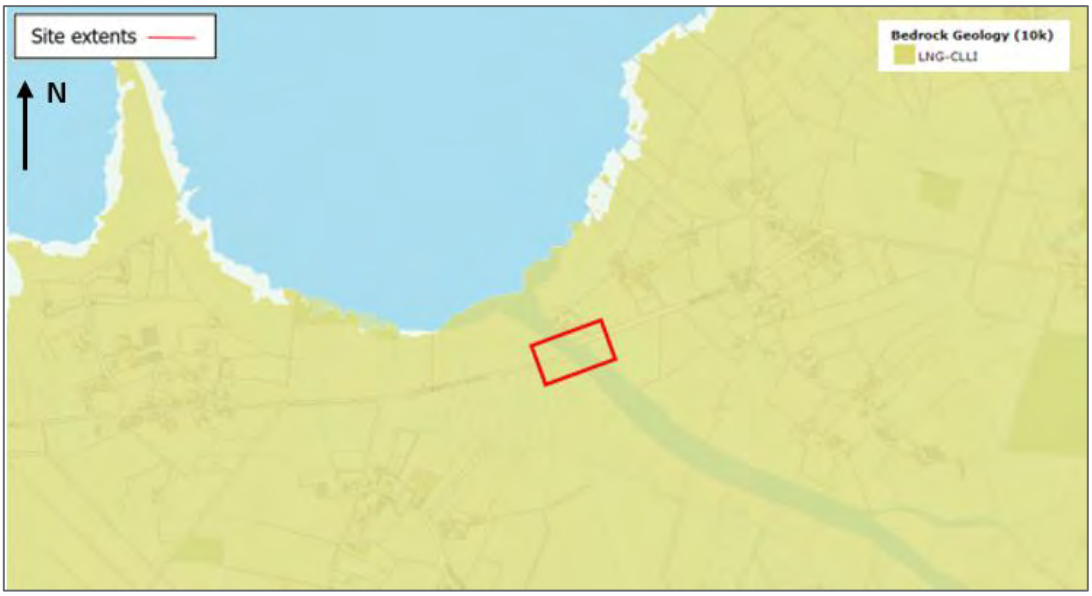

Figure *1-9*: Bedrock Geology Map (GSNI GeoIndex)

Ground Conditions and Material Properties

The published geological and historic ground investigation (GI) data records alluvial deposits immediately present at the foundation of the proposed bridge. In addition, the historic borehole engineering logs record soft/loose deposits to a depth of 15mbgl.

The following ground condition information has been recorded from the GSNI records:

Granular Alluvium

Typically described as loose light brown gravelly silty fine to medium grained SAND between 0.20m and 7.80m bgl. Test information for granular Alluvium recorded SPT 'N' values ranging from 4-7 blows with a bulk unit weight ranging between 15.5-17.5kN/m^3, indicating a loose sand material.

Upper Cohesive Alluvium

Typically described as very soft greyish brown highly organic silty CLAY/SILT between 1.10m and 7.80m bgl. In-situ tests recorded SPT 'N' values ranging from 1-2 blows with bulk unit weight ranging between 14-19kN/m3, suggesting a very low to low strength CLAY in accordance with BS8002.

In accordance with BS5930:2015 an undrained shear strength between 10-20kPa is envisaged for a very low strength clay. Direct tests for undrained shear strength recorded values ranging from 12-13kPa and a high compressibility clay is anticipated to be present.

Lower Cohesive Alluvium

Typically described as soft greyish brown laminated silty CLAY containing frequent partings of light brown silt and fine-grained sand between 11.00m and 15.50m bgl. Bulk unit weights were recorded between 15-19kN/m^3 and undrained shear strength between 20-40kPa indicating a high compressibility clay and low strength CLAY is present.

Peat

Described as very soft blackish brown silty amorphous PEAT between 2.45m and 4.30m bgl. Direct tests for bulk density recorded value between 10.65 and 13.61kN/m3. A conservative value for the effective critical state frictional angle for PEAT can be assumed to be 10°. Direct test for undrained shear strength recorded a value of 12kPa, indicating a very low strength material

Granular Glaciofluvial

Typically described as medium dense grey laminated silty fine to medium grained SAND between 7.40m and 11.70m bgl. Test information for granular Glaciofluvial recorded SPT 'N' values ranging from 11-31 blows which correlates with a medium dense SAND.

Groundwater Conditions

The highest groundwater level was recorded at 1.40mbgl in proximity to the proposed bridge abutment footprints. Varying groundwater levels were recorded at 4.30m and 8.10m bgl with moderate flows encountered during the ground investigation fieldwork.

1.3.2 Foundation Considerations

Preliminary assessment of the ground conditions suggests low bearing resistances from the existing superficial materials which are deemed insufficient to directly support (shallow foundations) bridge footings, abutments and associate earthwork approach embankments. Long-term differential settlement will also likely occur at the bridge abutment/earthwork interfaces and therefore deep foundations are likely required to transfer loads to more competent materials at depth. Design of pile foundations will also need to consider negative skin friction, due to the compressibility of the cohesive alluvial deposits recorded at depth. Differential settlement along the earthworks, between the earthworks and the proposed abutments, as well as within the proposed pile arrangement will need to be considered during design and monitored during construction.

It is anticipated that associated earthworks, comprising unreinforced approach embankments, will be required on both sides of the River Bann crossing to allow a minimum height clearance of the proposed bridge span. The proposed footprint of embankments may require significant excavation and replacement with imported granular compacted fill or ground improvement to support self-weight of the earthworks. In addition, slope stability will need to be assessed, notably where the earthwork extents encroach along the banks of the River Bann. Special earthwork support measures may be required where slope gradients exceed 1v:2.5h.

The proposed earthworks may also require erosion protection in the form of geo-matts, subject flooding levels. Temporary works during construction shall consider groundwater ingress within excavations and short-term stability requirements/control measures such as de-watering and formation protection.

1.3.3 Further Geotechnical Recommendations

It is recommended that a site-specific GI is undertaken to inform the detailed design of the selected option. Additional GI will also allow assessment of the design requirements of the associated earthworks along the chosen route. A seepage analysis may also be required to ensure adequate control of the surface and groundwater. The GI scope should comprise further exploratory holes to provide more detailed ground condition information for the proposed bridge footings/abutments, approach embankments, associated earthworks, pavement design and the reinstatement of existing fishing pontoons, if required. The GI shall include soil sampling, in-situ testing and soil/groundwater laboratory testing to facilitate detailed design. A chemical testing (BRE SD1) suite on soil samples would be required for the concrete design and to assess aggressivity of the ground and groundwater.

The project will likely be assigned a Category 2 geotechnical classification in accordance with CD622. Technical approval and certification requirements will require reporting from Statement of Intent (SOI) to Geotechnical Design Report (GDR) stages prior to construction and in accordance with CD 622; Managing Geotechnical Risk.

1.3.4 Geotechnical References

1. Stratex SI 1189/592, Proposed River Bann Crossing, Charlestown, Trial Boreholes, 1989 – BH01 & BH02.
2. Tomlinson, M.J. (2001). Foundation Design and Construction, 7th Edition.
3. BSI (2015) BS 8002:2015: Code of Practice for Earth Retaining Structures. BSI, BSI Standards Limited.
4. BSI (2015) BS 5930:2015: Code of Practice for Ground Investigations. BSI Standards Limited.
5. BS EN 1997-1:2004 + A1:2013 Eurocode 7: Geotechnical Design. Part 1: General Rules.
6. Geological Survey Northern Ireland, GSNI (2016). GeoIndex Map Viewer [ONLINE]Available at: https://mapapps2.bgs.ac.uk/GSNI_Geoindex/home.html [Accessed: 10th October 2022]
7. Design Manual for Roads and Bridges (DMRB) (2020). CD622, Geotechnics and Drainage, Earthworks, Managing Geotechnical Risk.

1.4. Design Criteria and Construction Envelope

1.4.1 Pedestrian/Cycle Bridge

The bridge shall be designed in accordance with the Design Manual for Roads and Bridges (DMRB), including CD353 '*Design criteria for footbridges*', CD 143 *'Designing for walking, cycling and horse riding'* and CD 195 '*Designing for cycle traffic*'. The requirements of the Department for Transport LTN 1/20 '*Cycle infrastructure design*' will also be considered. This is a guidance document for local authorities for designing high-quality, safe cycle infrastructure.

The bridge shall be designed for shared use of pedestrians and cyclists, with a white line and/or contrasting surface for segregation of pedestrian and cycle traffic. 1 no. 2.5m wide cycle path and 1 no. 1.5m wide footway shall be provided as per CD 353 Table 11.7, resulting in a deck width of 4m between parapets.

In the absence of stakeholder consultation at this stage of the project, the geometry of other nearby bridges over the River Bann has been considered to inform the required clearance envelope for the proposed crossing at Bannfoot. The closest bridge over the River Bann is the bridge that carries the M1, approximately 7km south-east of Bannfoot. This is a three-span structure with a vertical clearance of 3.1m over the water level at mid-span and a central span of 24.4m between piers. The total bridge span is 48.8m at this crossing. The proposed crossing at Bannfoot should as a minimum match the clearance envelope provided at the M1 River Bann Bridge, to ensure the clearance envelope for river uses is not compromised by a new structure. This may potentially be refined at later project stages when more detail is available on the requirements of key stakeholders. The proposed clearance envelope for a pedestrian/cycle bridge at Bannfoot is therefore as follows:

- Minimum vertical clearance over river level – 3.1m
- Clear span between abutments (for a single-span structure) – 40m at the proposed pedestrian/cycle bridge crossing point
- Minimum clear span between piers (for a three-span structure) – 24.4m.

1.4.2 Road Bridge

The bridge shall be designed in accordance with the Design Manual for Roads and Bridges (DMRB). It shall be designed to BS EN1991-2 Load Models LM1, LM2 and LM4. It shall also be designed for Special Vehicles model SV80 in accordance with CD 350 Table 7.6.2, provided in LM3 as defined in the UK NA to BS EN 1991-2.

For the purposes of this feasibility report it has been assumed that a road bridge would be designed to accommodate 2 No. 3m wide carriageway lanes and 2 No. 1m wide footpaths. 2 No. 0.5m wide parapet stringcourses would also be required, resulting in a 9m wide bridge deck.

As outlined in Section 1.4.1, the proposed clearance envelope for the proposed road bridge is based on the nearby M1 River Bann Bridge and will be as follows:

- Minimum vertical clearance over river level – 3.1m
- Clear span between abutments (for a single-span structure) – 52m at the proposed road bridge crossing point (for a single-span structure) – see Section 2.1.2 for further details
- Minimum clear span between piers (for a three-span structure) – 24.4m

1.5. Environmental Considerations

1.5.1 Environmental Constraints

A review of publicly available information was carried out in conjunction with a site visit in October 2022 to identify any environmental constraints or considerations for the scheme. Environmental constraints are shown on Figures B-1 and B-2 in Appendix B The study area was taken to be up to 1km from the site extents to identify any designated sites. Other environmental receptors, such as houses or cultural heritage sites were identified within 300m of the proposed bridge site.

Noise, Air Quality and Odour

The scheme lies within the Armagh, Banbridge and Craigavon City Council Air Quality Management Area (AQMA), which is designated for nitrogen dioxide, primarily from road traffic. The area is agricultural, the closest dwelling to the scheme is the house found immediately north of the east end of the scheme, but it is not known whether this dwelling is currently occupied. The next closest house is found 228m east of the scheme. The closest house on the west end of the scheme is found 454m south-west. There are clusters of dwellings found along the Columbkille Road 777m west and the Bannfoot Road 439m east in the village of Bannfoot. There are no known businesses within 500m of the scheme.

Landscape and Land Use

The scheme is located within the Regional Landscape Character Area 14 – the Lough Neagh Basin, which is an area that includes Ireland's largest body of water, Lough Neagh. The area is mainly characterised by low lying boggy land. Lough Neagh covers an area of 392km^2, the vast amount of water lies within a shallow basin formed from subsidence of a magma chamber after high levels of volcanic activity 35 million years ago. Many tributaries flow into it such as the Six Mile Water, Upper Bann, and only one outflowing river which is the Lower Bann. The land around the area is rural farmland, drumlins and peat dominate the south. Settlement is concentrated in the south at Portadown, Lurgan and Craigavon. There are extensive reedbeds, wet meadows, woodlands and scrub found on the shore. At Bannfoot, the land use is predominantly agricultural, used for grazing.

The house immediately north on Bannfoot Road will be the closest visual receptor during the construction and operation phase and the view will be permanently altered with the introduction of any new bridge.

Architecture and Cultural Heritage

A review of the Department for Communities Historic Environment website indicates the location of a Findspot of boat timber dated AD 1612 +/-, 34.2m south of the east side of scheme (SMR: ARM002:009), as shown on Figure 3-2.

The location of the ferry is listed in the Industrial Heritage Record, IHR00010:000:00, Bann Foot Ferry, located immediately to the west of the scheme, as shown on Figure 3-2.

No Scheduled Zones, Historic Parks and Gardens or Listed Buildings are found within 500m of the scheme.

Biodiversity

The scheme lies within the boundary of the Lough Neagh and Lough Beg Ramsar site. It is also adjacent to the Lough Neagh Area of Special Scientific Interest (ASSI) and Lough Neagh and Lough Beg Special Protection (SPA) Area. The lough is designated for its overwintering waterfowl populations and is an important habitat for a variety of rare plants and animals. The lough is home to important species such as Irish pollan, European eels, and salmon.

Local Wildlife Sites within 2km of scheme includes Derryinver 1.10km south-east of east end of scheme. There are areas of priority grassland and peat found within 2km of scheme. There are also records of breeding waders in and around the scheme extents associated with Lough Neagh.

The main habitats around the bridge location are grassland, hedgerows and the River Bann. There is potential for protected species such as otter, salmon and bats to be found in the vicinity of the scheme.

Water Environment and Drainage

The scheme is located at the River Bann, close to where it flows into Lough Neagh. The proposed location of the bridge, either the pedestrian or road bridge, lies partially within the flood plain of the River Bann. It is likely that the associated road improvements work and bridge embankments would encroach into the flood plain. Any design would therefore have to take flood risk into account.

Land Use and Community Facilities

The scheme is in a rural area with few residential properties. There are dwellings found along the Columbkille Road 777m west and the Bannfoot Road 439m east in the village of Bannfoot. There is a property found 56m north of the east end of the scheme. There is a pier located on the west bank of the river, which is most likely used for passing fishing boats. The main land use surrounding the scheme is agricultural.

Geology and Soils

Bedrock Geology in the area consists of Lough Neagh Clays – clay and lignite. Superficial geology of the area mainly consists of Lacustrine Alluvium – clay, silt and sand, though peat, glacial sand and gravel and till are also found. Soils in the area mainly consists of Inland water, but other soils within proximity to the scheme include Fluvisols, Stagnosols and Histosols.

The bedrock aquifer is Bp(f) which means small supplies may be possible, but strata is rarely exploited, with negligible regional flow and limited local flow. The groundwater vulnerability is classed as 1, which means it is only vulnerable to conservative pollutants in the long term when continuously and widely discarded and leached.

Historical industrial land use within 300m of the scheme includes a Mineral working site, which used to be a quarry in 1965, located 260m south of east end of scheme.

Waste

The closest waste centre to the scheme is Multifix Recycling, found 1.8km west of west end of scheme.

1.5.2 Recommendations

The provision of a new bridge at Bannfoot is likely to require environmental assessment as it progresses through design, irrespective of whether the preferred option is a footbridge or a bridge for vehicles. Once a preferred option is chosen, an EIA screening determination is recommended to ascertain if the scheme fulfils any of the criteria under the Environmental Impact Assessment Directive. Should the scheme be identified as EIA development, then a scoping report will be required to determine the scope of the EIA.

The preliminary desk top study identified that the following is likely to be required:

- An ecological assessment to determine if any protected species will be affected by the scheme or if any invasive species are within the scheme footprint.

- An assessment under the Habitats Regulations will be required as the scheme is located within the boundary of the Lough Neagh and Lough Beg Ramsar site and adjacent to the boundary of the Special Protection Area.
- Cultural Heritage Assessment, due to potential land take and proximity to cultural heritage resources.
- Water Impact Assessment, as the building of the new bridge over this watercourse, will potentially cause changes to the road and natural drainage, potentially traffic flow (if bridge for motor vehicles progressed) as well as potentially affecting water quality during construction.
- Health impact assessment may be required if a road bridge is built due to changes in accessibility of communities either side of the watercourse, as well as changes with air quality and noise as a result of more traffic in the area.
- Noise and air quality assessment required for operational effects if a road bridge is the preferred option.
- Landscape and Visual Impact Assessment required as a bridge will be the new feature in the landscape.
- Material assets and waste assessment may be required due to the reasonably large amounts of materials that will be required for the construction of the bridge.
- Further assessment regarding geology and soils needs to be reviewed once preferred option is determined, as the construction of a bridge may affect the soil and cause potential contamination.

1.6. Existing Infrastructure

The existing infrastructure in the immediate vicinity of the bridge location is as one would expect given the rural nature of the area in question and the low volume of traffic which it is required to carry. The existing conditions and constraints are depicted on drawing 402126-AMEY-00-XX-DR-C-00001 – Project constraints within Appendix A.

It is important that any upgrade works to the infrastructure in the vicinity of any proposed bridge is in keeping with the minor, rural, lightly-trafficked, low-speed roads in the area and adopting a "*quiet lane*" approach may be suitable for both the stretches of Bannfoot Road and Columbkille Road on the immediate approach to the access ramps should a pedestrian / cyclist bridge be considered. Such designated roads aim to "*maintain the character of minor roads by seeking to contain rising traffic growth that is widespread in rural areas*" (The Quiet Lanes and Home Zones (England) Regulations 2006) and although this legislation is specifically for England, this principle could be explored further and adopted for these roads given their rural nature and lack of through traffic.

1.6.1 C0160 Bannfoot Road

The C0160 Bannfoot Road to the east of the River Bann is an un-kerbed single carriageway of approximate 3m width with wide grass verges between the River Bann and its junction with Hill Lane (approximately 470m to the east) and overall is currently in relatively good condition. There is no streetlighting present and the carriageway is drained through open field drains at either side. There is a kerbed turning area approximately 30m from the water edge along with a fenced picnic area complete with picnic benches, grassed area, information boards and stepped access to the water's edge. Consideration should be given to acquiring land to relocate this amenity space for any options that impact it.

It is recognised that as this section of Bannfoot Rd serves only a handful of properties and field accesses and consequently the vehicle numbers are extremely low. This means that the chance of conflict between cyclists and vehicles or necessary overtaking would be very rare and consequently the existing width of approximately 3.5m would likely be deemed sufficient and in keeping with the nature of the local infrastructure. However, if it was forecast that traffic numbers were to increase in the future and to be in keeping with the guidance outlined within LTN 1/20 Table 7-2, increasing the width of Bannfoot to 4m minimum should be considered at the next design stage.

Conversely, if a 2-lane road bridge was proposed it would be prudent to either upgrade this section of carriageway to a 2-lane single carriageway or to include several formal passing bays along its length as a minimum.

Figure 1-10: C1160 Bannfoot Road

1.6.2 C0160 Columbkille Road

The C0160 Columbkille Road is a narrow, un-kerbed single carriageway of approximate width less than 3m throughout, with narrow grass verges and hedgerows lining each side. There are no formal passing points along this section of carriageway, but the gated field accesses along its length provide opportunity to do so if required; two vehicles meeting on this road would be highly unlikely given it is not a through route and has no facilities to draw members of the public. It is likely that this carriageway is utilised by farmers to gain access to the adjacent fields and perhaps those wishing to utilise the small quay on the river edge to launch a small boat, although due to lack of available parking this would be considered an infrequent event.

This carriageway is in extremely poor condition between its junction with Greenisland Road and its termination at the River Bann (approximately 490m), with numerous failures and sizable potholes throughout likely due to lack of maintenance and the use of the carriageway by heavy farm machinery. There is no streetlighting present and it is drained with open field drains at either side. There is a slight informal widening at the end to enable vehicles to turn and stepped access to the water edge.

Considerable carriageway upgrade works would be necessary to this length of road to ensure suitability for both non-motorised users and vehicular traffic, with the latter traffic requiring a higher specification carriageway of either two lanes or with formalised passing bays.

Given the nature of this carriageway and extremely low volume of traffic anticipated to use it, the existing width would be deemed be sufficient for cycle and pedestrian traffic if the "*quiet lane*" approach was taken to retain the character of the immediate area. It is highly unlikely that any conflict between a cyclist and motorised vehicle would occur should a pedestrian and cyclist bridge be introduced but full resurfacing would be required to create a safe surface for all road users.

Nevertheless, during detailed design it is recommended that the guidance set out in LTN 1/20 is considered, including the 4.0m minimum width it stipulates for shared use carriageways such as this in order to formally exclude the requirement for additional carriageway width.

Figure 1-11: C1160 Columbkille Road

1.7. Land and Property

Most of the land in the vicinity of the site is agricultural used for grazing livestock. There are 6 No. private properties on Bannfoot Road between Lough Lane / Hill Lane junction and the river edge. Only 1 No. of these properties is likely to be permanently impacted by the proposed works – this is a dwelling and associated farm buildings adjacent to the proposed eastern landing point of the proposed bridge. It is not known whether this dwelling is currently occupied. There are no private properties on the Columbkille Road between the Greenisland Road junction and the river edge. However there are two small jetties located along the western bank of the river, each within approximately 50m of the potential pedestrian/cycle bridge landing point, that are presumably used for mooring of small fishing boats.

The proposed bridge and associated embankment/road works would require permanent land take from the agricultural land beyond the DfI Roads highway boundary to the east and west of the river. Permanent land take would also be required from the property adjacent to the proposed eastern landing point. Temporary land take may also be required for construction, depending on the proposed construction sequence. The two jetties on the western bank would also potentially need to be relocated as part o

Land folio information has not been sought at this stage, so it is not clear how many landowners are impacted by each bridge option, but the layout plans shown in Appendix A give an appreciation of the third party land requirements for each proposal and an indicative allowance has been included in the cost estimate in Section 2.2.

Figure 1-12: Third party land to the south of Columbkille Rd.

1.8. Construction Logistics

The road at the east side the river provides better accessibility for construction with a larger area that could be used for a site compound. This road is also wider and is in much better condition than at the west side, providing better access for construction plant. The east side is more likely to be suitable for providing the main access for delivery of plant and other equipment and materials, as well as access for delivery of precast/prefabricated bridge deck elements and for a crane for bridge deck erection. Given the proposed deck span and width of the various bridge options, there is likely to be an element of bridge deck assembly on site before erection, so a large compound area would be required to facilitate this. The required size of plant for the delivery of precast/prefabricated deck elements and the crane should be considered as part of the design development, given that the maximum road width on approach to the proposed bridge location is 3m.

Figure 1-13: Example of Transportation of 4m Wide Prefabricated Pedestrian/Cycle Bridge Deck

Figure 1-14: Example of Crane Erection of 4m Wide Prefabricated Pedestrian/Cycle Bridge Deck

Figure 1-15: Example of Crane Erection of 4m Wide Prefabricated Pedestrian/Cycle Bridge Deck

A 4m wide pedestrian/cycle bridge is presented in this report as outlined in Sections 1.4 and 2.1.1. This deck width complies with CD 353 Table 11.7 and is considered suitable given that the Sustrans Loughshore Trail could potentially be rerouted over the bridge following construction. However due to the required bridge span and width, the existing 3m wide Bannfoot Road on approach is likely to provide a constraint on the size of structure that can be transported to site. Ideally the bridge deck would be transported to site in one piece for erection, but it is more likely that this would not be feasible due to the deck size, so the deck would be transported to site in a few large pieces, with final assembly required on site before the deck erection.

If the provision of 4m wide pedestrian/cycle bridge is cost prohibitive, a smaller deck width could be considered to potentially simplify transportation and reduce or eliminate the deck assembly on site before erection. A 3.5m wide deck would still comply with CD 353 Table 11.7, but the pedestrian and cycle paths would be unsegregated over the bridge. Given the rural location of the bridge and the 3m wide roads on approaches, consideration could also be given to reducing the deck width further to 3m wide to reduce costs. This would not comply with CD 353 but would provide a 2-way cycle track compliant with CD 195.

For the road bridge, it is anticipated that the ladder deck beams would be transported to site in smaller pieces and assembled on site before erection. As with the pedestrian/cycle bridge, there is potential to reduce the bridge deck width to reduce costs, especially given that the roads on approach are 3m wide. However, given the proposed 52m span of the road bridge option (see Section 2.1.2 for further details), reducing the deck width by a 2-3m would reduce costs associated with material quantities and tonnage of steel beams to be erected but would not remove the need for some element of ladder deck assembly to be undertaken on site.

Whilst most of the bridge construction could be undertaken from the east side, there are also some activities that would need to be undertaken from the west. The road at the west side would likely need to be widened to the Greenisland Road junction, as a minimum in the form of a temporary haul road, to provide suitable access for activities related to the abutment construction, including earthworks and piling.

2. Options Proposed

2.1. Options considered within this Report

The options considered in this report are listed below and are described in further detail in Sections 2.1.1 to 2.1.3, with options drawings provided in Appendix A. Appendix A-5 shows drawings for different possibilities for Option 1 - Pesdestrian/Cycle Bridge while Appendix A-6 and A-7 contains drawings for Option 2 – Road Bridge.

2.1.1 Option 1 – Pedestrian/Cycle Bridge

This option comprises a single-span pedestrian/cycle bridge with a deck width of 4m between parapets to accommodate shared pedestrian and cyclist use, with a white line and/or contrasting surface provided for segregation of pedestrian and cycling traffic. A 2.5m wide cycle path and 1.5m wide footpath would be provided as per CD 353 Table 11.7. The bridge would cross the river at the termination point of the two existing roads, with a clear span of approximately 40m and no skew.

Ramps are required at each bridge abutment to provide access to the bridge deck from the approach roads. The ramps are required to have a maximum gradient of 5%, with landings at every 500mm route rise to comply with DMRB and LTN 1/20. Various ramp options were investigated as part of the optioneering – the proposed ramp arrangement is provided below in Figure 2-1. This is considered the most suitable ramp arrangement when considering the impacts on the existing property to the north-east of the bridge, impacts on agricultural land take and the required quantity of earthworks. The footprint of the eastern ramp will require the realignment of a ditch along the field boundary running into the 'bay' area at the east of the river – see options drawings in Appendix A-4 and A-5 for further details. Other ramp options may be considered at later project stages if engagement with landowners introduces project constraints that are not known at this stage. The Columbkille Road to the west of the river would also be resurfaced up to the Greenisland Road junction as depicted on 402126-AMEY-00-XX-DR-C-00012 Proposed Foot Bridge in Appendix A.

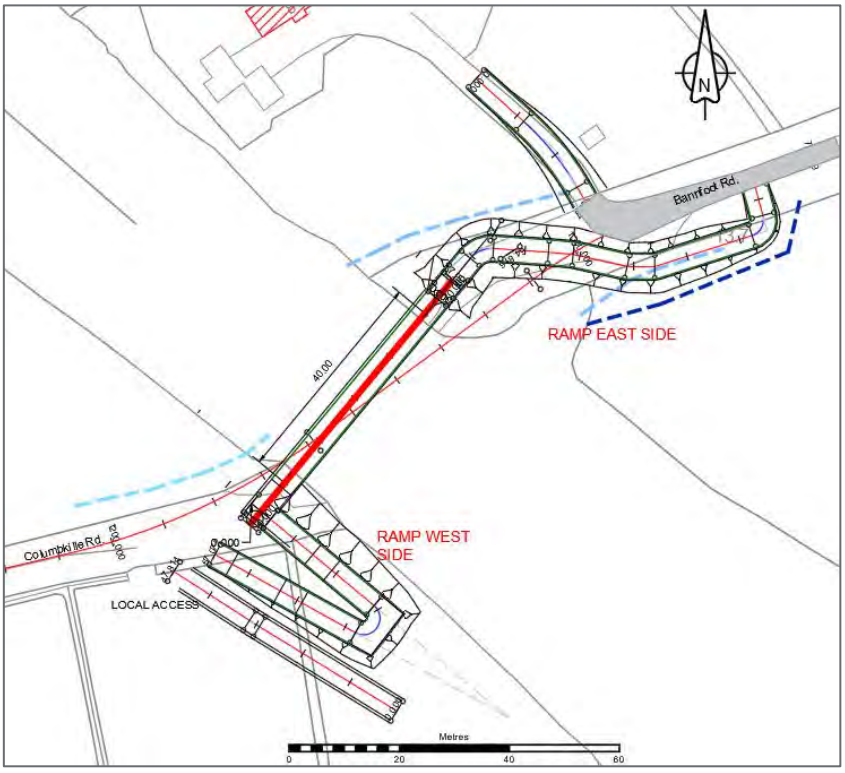

Figure 2-1: Proposed Pedestrian/Cycle Bridge Arrangement

A pedestrian/cycle bridge would benefit the local communities each side of the River Bann. The bridge would permit the Sustrans Loughshore Trail to have a continuous cycle route around the Lough Neagh and help to develop the rural communities of Maghery and Bannfoot.

3 No. pedestrian/cycle bridge sub-options have been considered in this report, each with a different superstructure structural form as presented below and within the drawings within Appendix A-5. With the available ground information at this stage, it is assumed that the substructure for each option would comprise reinforced concrete bored piled abutments with a reinforced concrete capping beam. The substructure would be supported on bearings at each abutment.

a) Warren truss bridge – The Warren truss consists of longitudinal members joined only by angled cross-members, forming alternately inverted equilateral triangle-shaped spaces along its length. This gives a pure truss – each individual strut, beam, or tie is only subject to tension or compression forces, there are no bending or torsional forces on them. This configuration combines strength with economy of materials and can therefore be relatively light. This form of truss is ideal for use in prefabricated modular bridges. Example of a Warren truss footbridges can be seen below. A option drawing for this type of bridge

Figure 2-2: Examples of Warren Truss Bridges

The advantages and disadvantages of a Warren truss bridge at this location are outlined below.

Advantages:

- The Warren truss structure is the cheapest of the all the bridge options.
- It is the simplest to build to build as the deck can be constructed in line with main beams. It is also the simplest to maintain over its life cycle
- It is the lightest bridge option and the smallest substructure and, consequently, would require less associated earthworks and intrusion on existing embankments.

Disadvantages:

- Less aesthetically pleasing than the other pedestrian bridge options
- The steel truss would cause higher obstruction of countryside view for users comparatively to arch bridges and have a bigger impact in the scenery
- Tends to have higher number of welded connections than other types of bridges which can increase the risk for defects and higher maintenance costs

b) Tied Arch bridge – A tied-arch bridge is an arch bridge in which the horizontal forces of the arch are taken as a tension force by the bottom chord which ties both arch ends together. This

strengthened chord may be the deck structure itself or consist of separate, deck-independent tie-rods. Tied arch structures can create iconic landmarks due to their appearance. The deck appears to hang off the arch using cables / rods which creates a light elegant appearance for the structure. Tied arches are more expensive and more difficult to construct than the truss options, but a 40m span is very much achievable at this site. Examples of tied arch footbridges can be seen below.


Figure 2-3: Examples of Tied Arch Bridges

The advantages and disadvantages of a tied arch bridge at this location are outlined below.

Advantages:

- The tied arch bridge is more elegant and aesthetically pleasing that the Warren truss.
- It creates a less obstructive view of the local scenery
- Due to its design, it could represent a local landmark/attraction and bring more users and business to local communities.

Disadvantages:

- Less aesthetically pleasing than the butterfly arch bridge
- It is more complex to build in comparison with Warren truss structure
- Higher cost than the Warren truss structure

c) Butterfly arch bridge – The butterfly arch bridge form is similar to the tied arch form described above. The only difference with the butterfly arch is that the arches that support the deck are tilted outwards to create a more striking aesthetic. Examples of butterfly arch footbridges are shown below.


Figure 2-4: Examples of Butterfly Arch Bridges

The advantages and disadvantages of a Butterfly Arch bridge at this location are discussed below.

Advantages:

- The Butterfly Arch bridge is the most elegant and aesthetically pleasing of all bridge options.
- It creates a less obstructive view of the local scenery
- Due to its design, it could represent a local landmark/attraction and bring more users and business to local communities.

Disadvantages:

- The butterfly arches require the largest substructure and would require larger associated earthworks and intrusion on existing embankments.
- It is the most complex and expensive to build of the pedestrian bridge options

A single-span pedestrian/cycle bridge is presented in this report as it is considered that despite the large span, a single-span structure is preferrable to a three-span structure. A three-span structure would require the construction of two piers in the river, which would introduce additional substructure construction costs, increase the construction programme, and introduce additional health and safety risks and environmental risks during construction. The piers would also result in increased and future inspection/maintenance costs. However, at a later project stage it may be decided to investigate a three-span bridge in further detail if it is considered that the above disadvantages are outweighed be the advantages associated with the savings in deck fabrication, delivery and erection costs.

There is also the potential to investigate the provision of a smaller deck width at later project stage, should a 4m wide pedestrian/cycle bridge be cost prohibitive. This is discussed in further detail in Section 1.8.

2.1.2 Option 2 – Road Bridge

This option comprises a single-span integral road bridge with deck width of 9m to accommodate a 6m wide 2-lane carriageway, 2 No. 1m wide footpaths and 2 No. 0.5m wide parapet stringcourses. The bridge would cross the river approximately 50m south of the termination point of the two existing roads, with a clear span of approximately 52m and 7º skew.

Various alignment options were investigated as part of the optioneering – the proposed arrangement is provided below in Figure 2-5, and within Appendix A-6 and A-7.. This is designed to a road speed of 60 kmph with a safe stopping distance of 90m in accordance with CD 109. This is considered to match the existing road characteristic and will not encourage higher driving speeds over the realigned section of road at the bridge. The proposed bridge location also avoids the 'bay' area close to the existing Bannfoot Road termination point, helping to limit the required bridge span. This alignment is considered the most suitable when considering the optimum location for a cost-effective bridge span and earthworks solution and limiting the impacts on road safety, the existing property to the north of the bridge and on agricultural land take. Other alignment options may be considered at later project stages if engagement with landowners introduces project constraints that are not known at this stage. The road bridge option also includes the upgrading of the Columbkille Road beyond the realigned section, to include resurfacing and widening to a 3m width up to the junction with Greenisland Road as shown on drawing 402126-AMEY-SBR-XX-DR-CB-00004 – Option 2 Road Bridge within Appendix A-7.

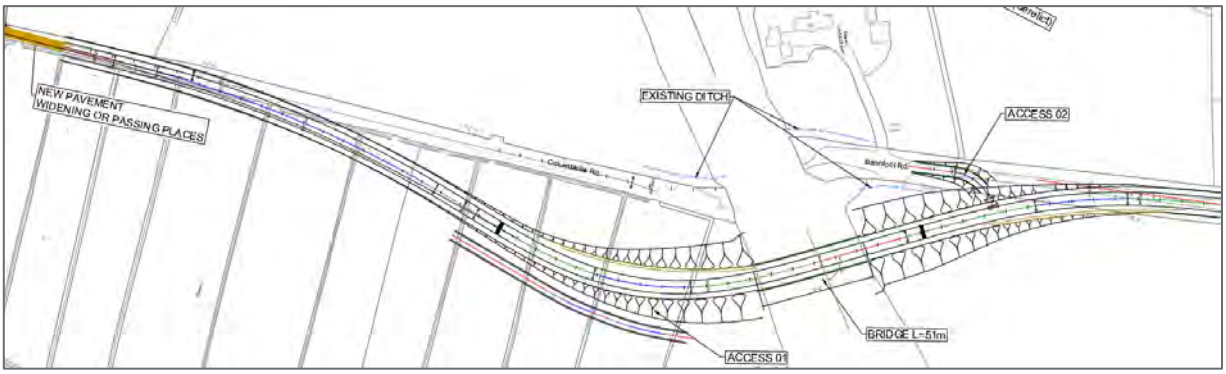

Figure 2-5: Road Bridge Proposed Alignment.

A road bridge at this location would require considerable earthworks beyond each end of the bridge to provide a vertical road alignment that complies with standards whilst achieving the required 3.1m vertical clearance over the river and the required bridge deck structural depth for the 52m span. A steel-composite ladder deck is proposed as it typically provides a more efficient structure than precast concrete beams for this large span, helping to minimise deck structural depth and the extent of embankments required beyond the bridge. A ladder deck comprises two main longitudinal steel girders with transverse steel cross girders spanning transversely between the main girders. An in-situ concrete deck slab is provided above to act compositely with the steel girders. The steel-composite deck would be integral with the bridge abutments, removing the need for bridge bearings and deck expansion joints, providing a significantly more durable structure with reduced required future maintenance interventions. With the available ground information at this stage, it is assumed that the abutments would comprise reinforced concrete bored piles with a reinforced concrete capping beam. Some examples of ladder deck composite bridges can be seen in the figures below.

Figure 2-6: Examples of Steel-Composite Ladder Deck Bridges

As with Option 1, a single-span road bridge is presented in this report as it is considered that despite the large span, a single-span structure is preferrable to a three-span structure. However, at a later project stage it may be decided to investigate a three-span road bridge in further detail if it is considered that the above disadvantages are outweighed be the advantages associated with the savings in deck structural depth and associated embankments costs.

If a road bridge is preferred, there is also the potential to investigate the provision of a smaller deck width at later project stage, if a 9m wide deck is cost prohibitive. This is discussed in further detail in Section 1.8.

The advantages and disadvantages of a road bridge at this location are discussed below.

Advantages:

- Benefits both motorised and non-motorised road users

- Helps the development of local communities

Disadvantages:

- Significantly more expensive than a pedestrian/cycle bridge
- Greater aesthetic impact on this scenic area when compared to a pedestrian/cycle bridge
- Much greater impact on existing agricultural land, due to the required permanent land take to accommodate the required embankments beyond the bridge to accommodate the greater structural depth of the road bridge option.
- Greater impact on the existing property to the north-east of the proposed bridge.
- Existing substandard roads at both sides would need to be upgraded substantially to permit a higher effluence of motorised traffic
- Increased noise and pollution due to higher effluence of road traffic

2.1.3 Option 3 – No Bridge

If no bridge is provided, there will be no link between the C0160 Columbkille Road and C0160 Bannfoot Road, and therefore no improvement to the journey times for the local communities traveling between Bannfoot and Maghery. Furthermore, the users of the Sustrans Loughshore Trail will continue to be required to complete a similar diversion from the shores of Lough Neagh, as the absence of a link at this location represents the only break in a possible continuous cycling route around the shores of Lough Neagh.

The advantages and disadvantages of a not providing a bridge at this location are discussed below.

Advantages:

- No cost
- No environmental or visual impacts

Disadvantages:

- No link between communities
- Same journey diversions and delays
- No improvement to Sustrans Lougshore Trail
- Isolation of rural communities
- Hinders the development of nearby communities

2.2. Approximate Costs

2.2.1 Option 1 – Pedestrian/Cycle Bridge

Several bridge deck suppliers were contacted to help accurately estimate the cost of the superstructure for each of the three pedestrian/cycle bridge sub-options. Construction cost estimates for each of the sub-options are provided below in Error! Reference source not found.. These cost estimates include the resurfacing o f 490m of Columbkille Road, from the river to the Greenisland Road junction.

Activity	Option 2A Warren Truss	Option 2B Tied Arch	Option 2C Butterfly Arch
Preliminaries	£	£	£
Earthworks (including ramps and revetments)	£	£	£
Piling	£	£	£
Bearings	£	£	£
Abutments + other concrete structures	£	£	£
Pavements & Footways	£	£	£
Superstructure	£	£	£
Landscape	£	£	£
Miscellaneous (incl. resurfacing Collumbkille road, waterproofing, protections, etc.	£	£	£
Subtotal			£
Risk (15% Assumed)			£
Optimism Bias (15% of Subtotal + Risk Assumed, as per TAG UNIT A1.2 Table 8)			£
Total	£1,110,585	£1,375,085	£1,472,922

Table 2-1 – Pedestrian/Cycle Bridge Sub-Option Cost Estimates. Note: VAT is not included in the Costs

2.2.2 Option 2 – Road Bridge

The construction cost for the road bridge option has been estimated and is provided in Table 2-2 below. This includes all required earthworks and highways costs beyond the proposed bridge, including the upgrading of the Columbkille Road up to the Greenisland Road junction.

Activity	Road Bridge
Preliminaries & site clearance	£
Earthworks (including embankments)	£
Piling	£
Bearings	£
Steel Structure	£
Abutments, deck & other concrete structures	£
Pavements & Footways	£
Landscape	£
Miscellaneous (incl. restraint systems, drainage, road marking etc.)	£
Subtotal	
Risk (15% Assumed)	
Optimism Bias (15% of Subtotal + Risk Assumed, as per TAG UNIT A1.2 Table 8)	
Total	£3,504,704

Table 2-2: Road Bridge Cost Estimate. Note: VAT is not included in the Costs

2.3. Carbon Footprint

2.3.1 Legislation & Policy

Climate Change Act (Northern Ireland) 2022

The Climate Change Act (NI) 2022 sets "*targets for the years 2050, 2040 and 2030 for the reduction of greenhouse gas emissions; to provide for a system of carbon budgeting; to provide for reporting and statements against those targets and budgets; to confer power to impose climate change reporting duties on public bodies; to provide for reports and advice from the Committee on Climate Change; and for connected purposes.*"

DfI Carbon Management Document

This document, introduced in 2019, defines the procedures for the implementation of carbon management procedures and outlines that the preparation and design stage is the optimal stage to develop carbon management strategies.

2.3.2 Definition

The DfI Roads Carbon Management document, defines the carbon footprint as "*an estimate of the climate change impact of our activity or process – such as product manufacture or company operation.*"

2.3.3 Process

A high-level calculation of the of the carbon footprint was undertaken in accordance with PAS 2080.

For this calculation the following assumptions were used:

- Materials / waste will be transported 50km
- Service life of the infrastructure project will be 120 years
- Preliminaries not included
- Demolition of existing structures not included
- Service diversion not included
- White lining not included

As this was a high-level calculation only the following was included:

- Excavation
- Fencing
- Road restraint system / pedestrian guardrails
- Drainage
- Import of fill

- Pavement / footways
- Piling
- Structural concrete
- Paint systems
- Waterproofing

2.3.4 Results

Category	Pedestrian/Cycle Bridge (t CO2e)	Road Bridge (t CO2e)
Construction	485	1,727
Transport	29	195
Material replacement and refurbishment	60	2,895
End of life	5	55
Total	579	4,872

Table 2-4: Carbon Footprint

3. Summary and Recommendations

3.1. Summary table

The findings of this feasibility study are summarised in the table below:

Assessment criteria	Comments
Cost	There is a significant cost difference between the road bridge option (£3.50m) and the pedestrian/cycle bridge options (ranging from £1.11m to £1.47m). The pedestrian/cycle bridge is likely to require more future maintenance interventions, as the bearings will need to be replaced and the superstructure is likely to need repainting during the lifespan of the structure, whereas the road bridge would be integral with weathering steel beams. However, given the difference in capital cost, the anticipated whole life cost for the pedestrian/cycle bridge options would still be significantly lower than the road bridge.
Aesthetics	Considering the rural and scenic location of the site beside the River Bann and close to Lough Neagh, the pedestrian/cycle bridge options are significantly more aesthetically pleasing than a road bridge, especially considering the required deck structural depth and extent of approach embankments for the road bridge. The two arch options are the most aesthetically pleasing of the pedestrian/cycle bridge options but have a greater cost than the Warren truss option.
Durability and operation / maintenance	All options are durable design solutions and will be designed for design working life of 120 years. The superstructures will be designed with suitable falls to drain water off the deck. An approved waterproofing system will be used on the deck and all buried concrete surfaces will also be appropriately waterproofed. The road bridge would have a slight advantage due to having no deck expansion joints at the abutments. However due to the class of road, issues associated with potential leaking deck expansion joints (such as chloride attack on the reinforced concrete abutments) are not anticipated to be significant for the pedestrian/cycle bridge.
Buildability	Due to the required bridge span and width, there is anticipated to be an element of superstructure assembly on site before erection. For the pedestrian/cycle bridge, the existing 3m wide Bannfoot Road on approach to the site is likely to provide a constraint on the size of structure that can be transported to site. Ideally the bridge deck would be transported to site in one piece for erection, but it is more likely that this would not be feasible due to the deck size, so the deck would be transported to site in a few large pieces, with final assembly required on site before the deck erection. For the road bridge, it is anticipated that the ladder deck beams would be transported to site in smaller pieces and assembled on site before erection. All options will require a significant size of crane for erection of the deck steelwork. Consideration will need to be given to the crane access to site along the Bannfoot Road and temporary crane platform requirements during construction. All options are likely to require piles for the bridge abutments. Consideration will need to be given to piling rig access to site and temporary piling platform requirements during construction.

Function	All bridge options will provide a link for the Sustrans Loughshore Trail cycle route which would enable the route to stay relatively close to Lough Neagh on scenic and quiet roads, rather than divert to Portadown to cross the River Bann. The road bridge option will provide a useful link for locals to travel east-west between Bannfoot and Maghery without lengthy diversion. However, it is anticipated that there would not be significant outside of the local community. Given the anticipated use of the new road bridge, the additional cost of the road bridge is not considered to outweigh the advantages associated with the provision of the new road link in this area.
Highway works	Upgrade of the Columbkille Road between the river and the Greenisland Road junction would be required for all bridge options. However more extensive upgrade works would be required for a road bridge, in the form of either carriageway widening or the provision of passing bays, plus realignment works on the approach to the bridge. For the Bannfoot Road, the provision of passing bays as a minimum would also be required for a road bridge, plus realignment works on the approach to the bridge. Works to the Bannfoot Road for the pedestrian/cycle bridge would be minimal, other than works to tie into the eastern ramp. The amenity / picnic area at the east of the river may also be relocated to the north or south for both options.
Lands	Small areas of permanent land take would be required for the pedestrian/cycle bridge options to accommodate the bridge abutments, wingwalls, ramps and potential relocation of the amenity area at the east of the river. The road bridge would require significantly larger areas of permanent land take to accommodate the bridge, the road realignment on approach to the bridge and the significant lengths of new embankments beyond the bridge.
Geotechnical	Preliminary geotechnical assessment indicates low bearing resistances from existing superficial materials which are deemed insufficient to directly support (shallow foundations) bridge footings, abutments and associate earthwork approach embankments. Long-term differential settlement will also likely occur at the bridge abutment/earthwork interfaces and therefore deep foundations are likely required to transfer loads to more competent materials at depth. The proposed footprint of embankments may require significant excavation and replacement with imported granular compacted fill or ground improvement to support self-weight of the earthworks. In addition, slope stability will need to be assessed, notably where the earthwork extents encroach along the banks of the River Bann. Special earthwork support measures may be required where slope gradients exceed 1v:2.5h.
Environmental	For all bridge options there is likely to be impacts during construction on ecology, water, soils, local population from disturbance and landtake. Additional assessment will be required during future project stages.
Carbon footprint	The calculated carbon content of the road bridge is over eight times greater than that of the pedestrian/cycle bridge.

3.2. Recommendation

Option 1 (Pedestrian / cycle bridge) is the preferred option to cross the River Bann at Bannfoot. The cost of this type of bridge is significantly lower than for a road bridge and the pedestrian/cycle bridge is more aesthetically pleasing in this rural and scenic environment. This option also has a significantly lower carbon content and presents benefits in terms of reduced land take and reduced impact on the nearby property. Given the analysis undertaken, the rural location, class of road approaching the site and the relatively small numbers that would regularly use a road bridge, the benefits offered by the road bridge do not outweigh the benefits offered by the pedestrian/cycle bridge, particularly the cost and carbon savings.

Option 1 has a considerable cost, but it is preferred over Option 3 (no bridge) as the pedestrian/cycle bridge offers significant benefits in terms of connecting the communities for non-motorised users and providing a link for the Sustrans Loughshore Trail cycle route, which would enable the route to stay relatively close to Lough Neagh on scenic and quiet roads, rather than divert to Portadown to cross the River Bann.

Of the three pedestrian/cycle bridge sub-options, the tied arch option is preferred as it is deemed to be aesthetically pleasing, providing a modern and iconic structure that will help bring more pedestrians and cyclists to the area, whilst being slightly less expensive than the butterfly arch option.

Appendix A: Options Drawings

Appendix A-1 : 402126-AMEY-00-XX-DR-C-00001 – Project constraints

Appendix A-2 : 402126-AMEY-00-XX-DR-C-00002 – Necessary Diversion Routes

Appendix A-4: 402126-AMEY-00-XX-DR-C-00012 Proposed Foot Bridge

Appendix A-5 : 402126-AMEY-SBR-XX-DR-CB-00001 Pedestrian / Cycle bridge – Warren Truss

402126-AMEY-SBR-XX-DR-CB-00002 Pedestrian / Cycle bridge – Tied Arch

402126-AMEY-SBR-XX-DR-CB-00003 Pedestrian / Cycle bridge – Butterfly Arch

Appendix A-6 : 402126-AMEY-00-XX-DR-C-0XXXX – Proposed Road Bridge (Sheet 1 of 2)

402126-AMEY-00-XX-DR-C-0XXXX – Proposed Road Bridge (Sheet 2 of 2)

Appendix A-7 : 402126-AMEY-SBR-XX-DR-CB-00004 – Option 2 Road Bridge

File ref - c:\users\502923\downloads\402126-amey-00-xx-dr-c-00002 project constraints.dwg

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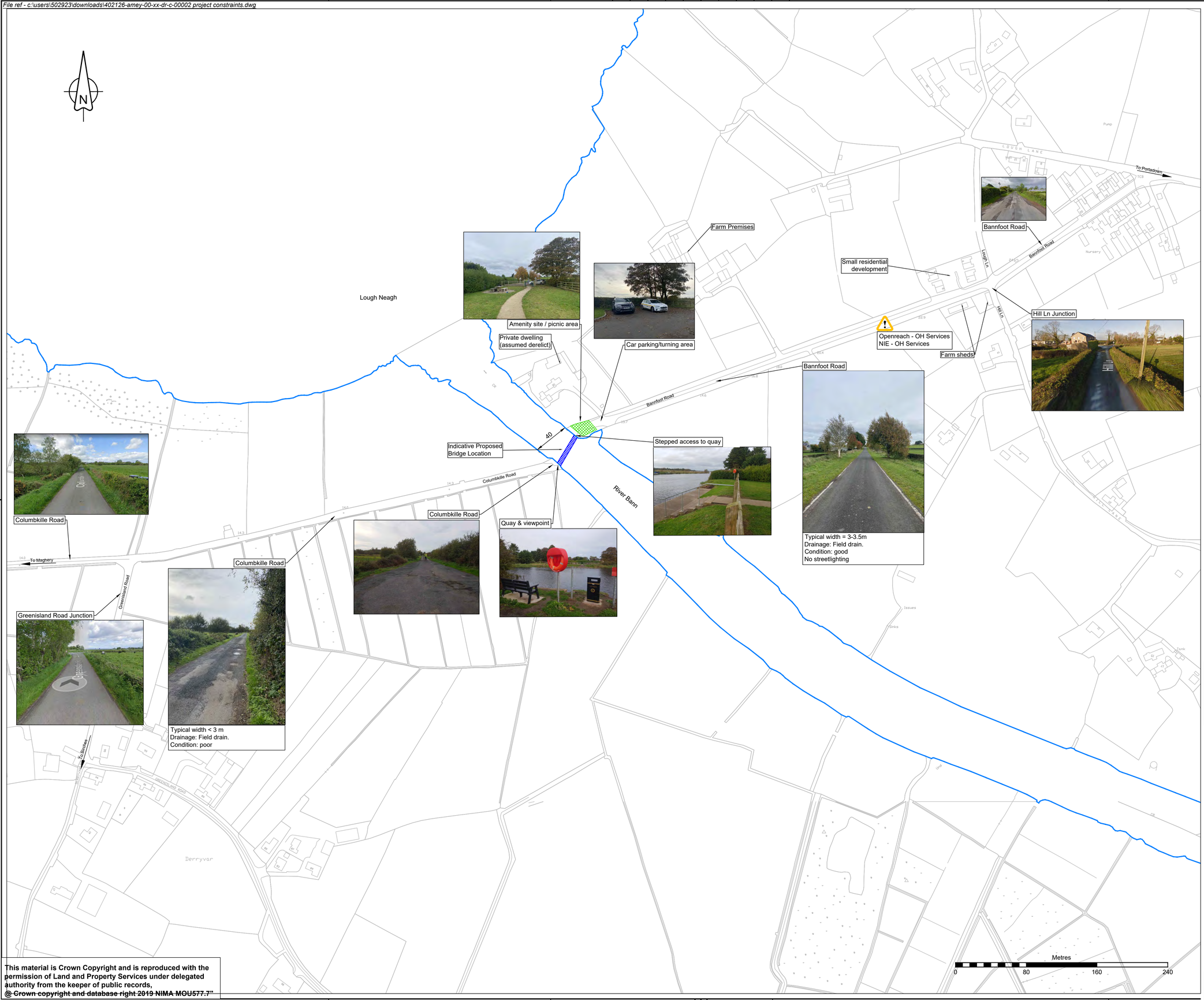

KEY

- Existing Picnic Area
- Indicative proposed bridge location

Rev	Revision details	Drwn	Chkd	Appd	Date

Designed:		Date: 16/11/2022
Drawn:		Date: 01/12/2022
Snr Tech Check:	-	Date: -
Checked:		Date: 31/01/2023
Approved:		Date: 01/02/2023

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Project Name
Bannfoot Bridge Feasibility Study

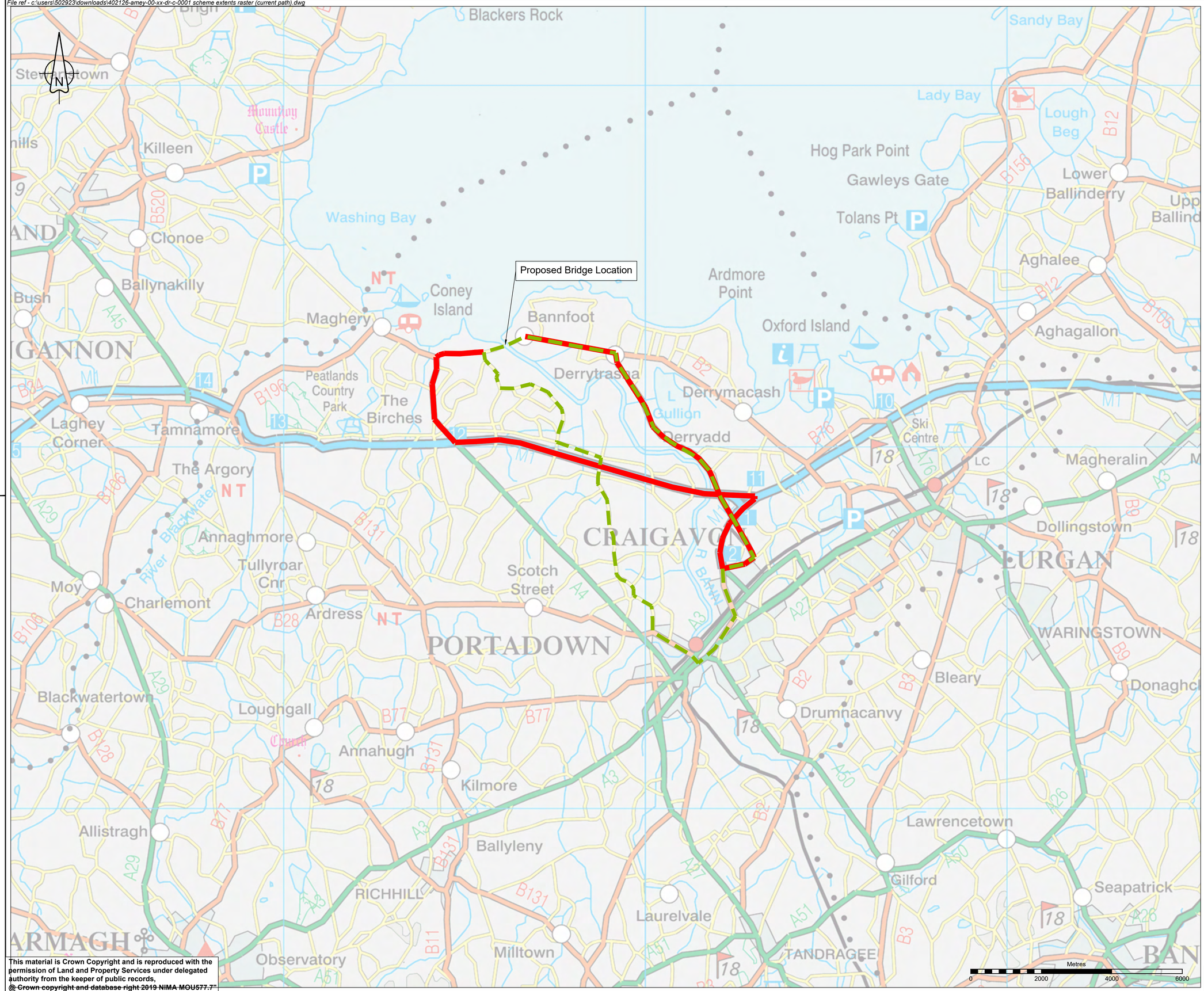
Drawing Title
Project Constraints

Original Drawing Size : A1	Scale : 1:2000 @ A1
Dimensions :	

Drawing Status	Suitability
SUITABLE FOR INFORMATION	S2

Drawing No	Rev
402126-AMEY-00-XX-DR-C-00002	P01

File ref - c:\users\502923\downloads\402126-amey-00-xx-dr-c-0001 scheme extents raster (current path).dwg



KEY

Existing route by car via M1
Travel time: 25 minutes
Distance: 16.3 miles

Existing route for cyclists avoiding M1
Travel time: 1hr 30 minutes
Distance: 17 miles

Rev	Revision details	Drwn	Chkd	Appd	Date

Designed:		Date: 16/11/2022
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Checked:		Date: 31/01/2023
Approved:		Date: 31/01/2023

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Project Name
Bannfoot Bridge Feasibility Study

Drawing Title
Necessary Diversion Routes

Original Drawing Size : A1	Scale : NTS
Dimensions :	

Drawing Status	Suitability
SUITABLE FOR INFORMATION	S2

Drawing No	Rev
402126-AMEY-00-XX-DR-C-00001	P01

File ref - c:\users\502923\downloads\402126-amey-00-xx-dr-c-00011-00012 foot bridge - bannfoot rd options new.dwg

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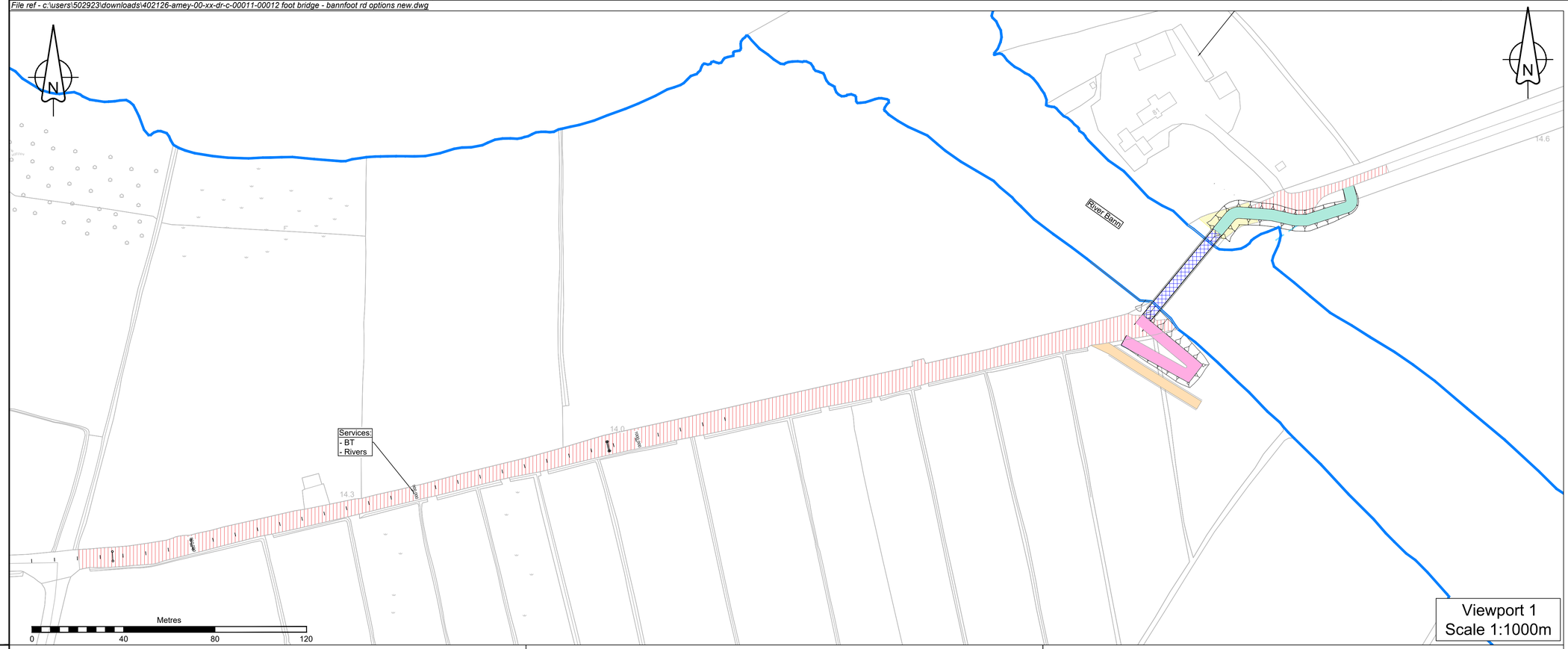


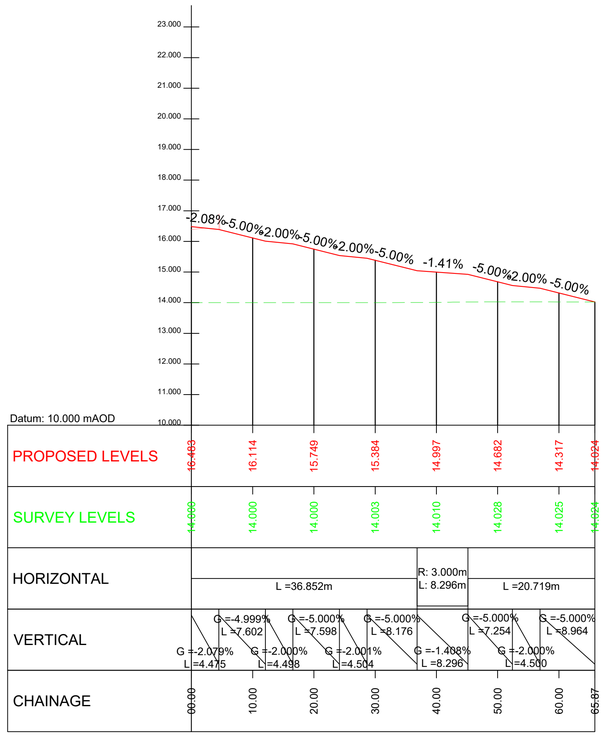
Viewport 1
Scale 1:1000m

NOTES

1. All dimensions are in meters unless stated otherwise.
2. Existing levels have been taken from OS mapping/Northern Ireland topographical map and are in meters above ordnance datum.

KEY

- Proposed footbridge (Span = 48m)
- Bannfoot Road ramp (Length = 71m)
- Columbkille Road ramp (Length = 69m)
- Existing access to be realigned
- Carriageway resurfacing
- Picnic area to be removed
- Existing field drain to be culverted/redirected



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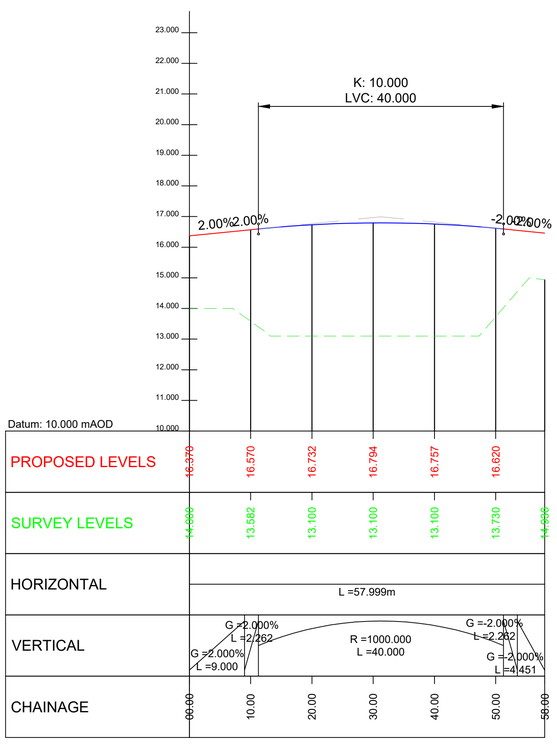
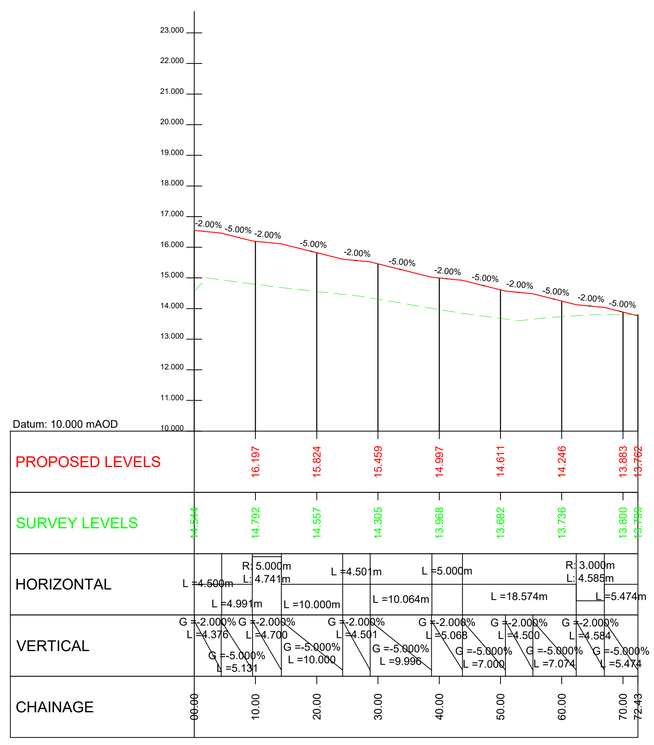
SCALE: H 1:500,V 1:100.

Viewport 2
Scale 1:500m



ALG_001_FOOT BRIDGE - LONGSECTION
SCALE: H 1:500,V 1:100.

Viewport 3
Scale 1:500m



ALG_003_RAMP EAST OPT2 - LONGSECTION
SCALE: H 1:500,V 1:100.

Viewport 4
Scale 1:500m

Rev	Revision details	Drwn	Chkd	Appd	Date

Designed:		Date: 15.12.23
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Snr Tech Check:	.	Date: .
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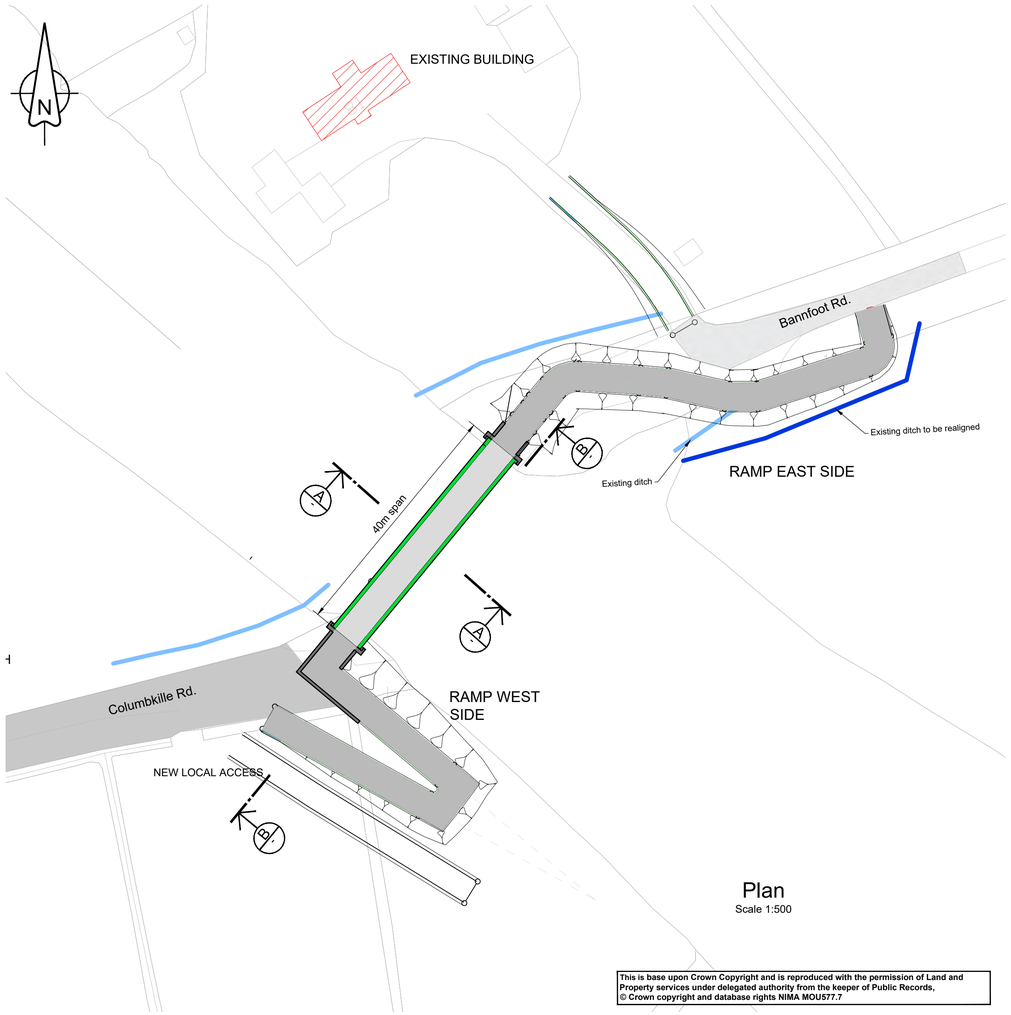
Project Name
Bannfoot Bridge Feasibility Study

Drawing Title
Proposed Footbridge

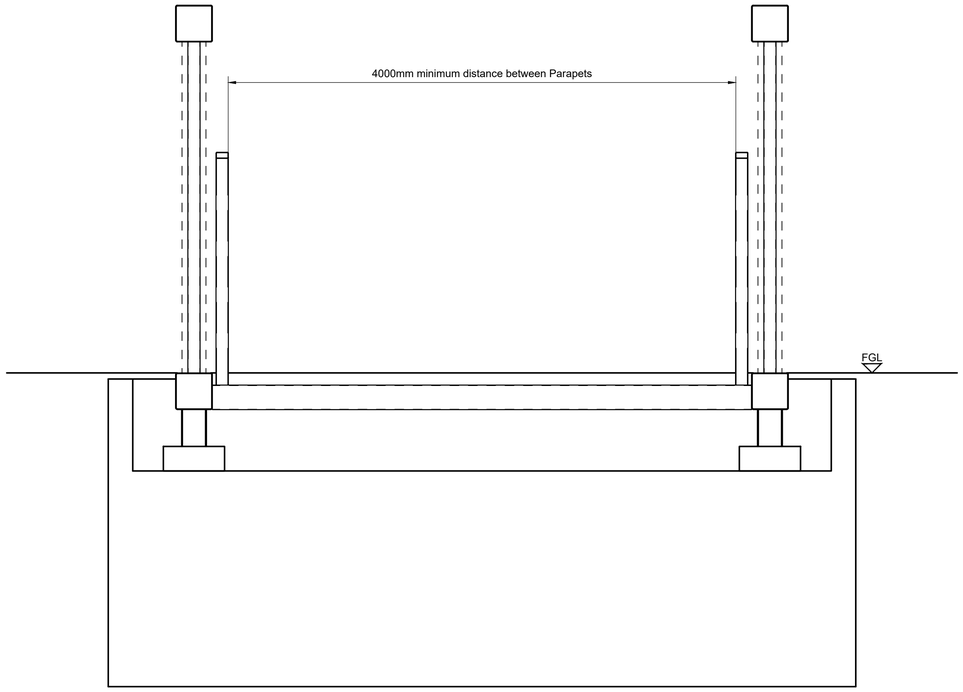
Original Drawing Size : A1	Scale : 1::500
Dimensions : -	

Drawing Status	Suitability
SUITABLE FOR INFORMATION	S2

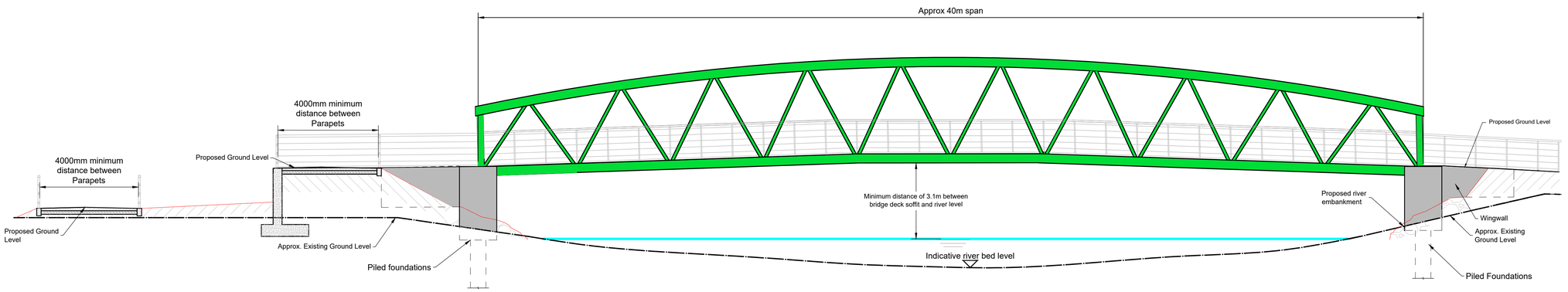
Drawing No	Rev
402126-AMEY-00-XX-DR-C-00012	P01



Plan
Scale 1:500



Section A-A
Scale 1:25



Elevation B-B
Scale 1:100

NOTES

1. All dimensions in millimetres unless otherwise stated.
2. This drawing is to be read in conjunction with the drawing series CO402126-AMEY...
3. Do not scale from this drawing - use only values of stated dimensions.
4. Site extents are approximate

KEY

- Existing River Bed / Ground Level
- Existing River Level
- Existing ditch
- Realigned ditch

Rev	Revision details	Drwn	Chkd	Appd	Date

Designed:	Date:	10/01/2023
Drawn:	Date:	20/01/2023
Snr Tech Check:	Date:	26/01/2023
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Approved:	Date:	01/02/2023

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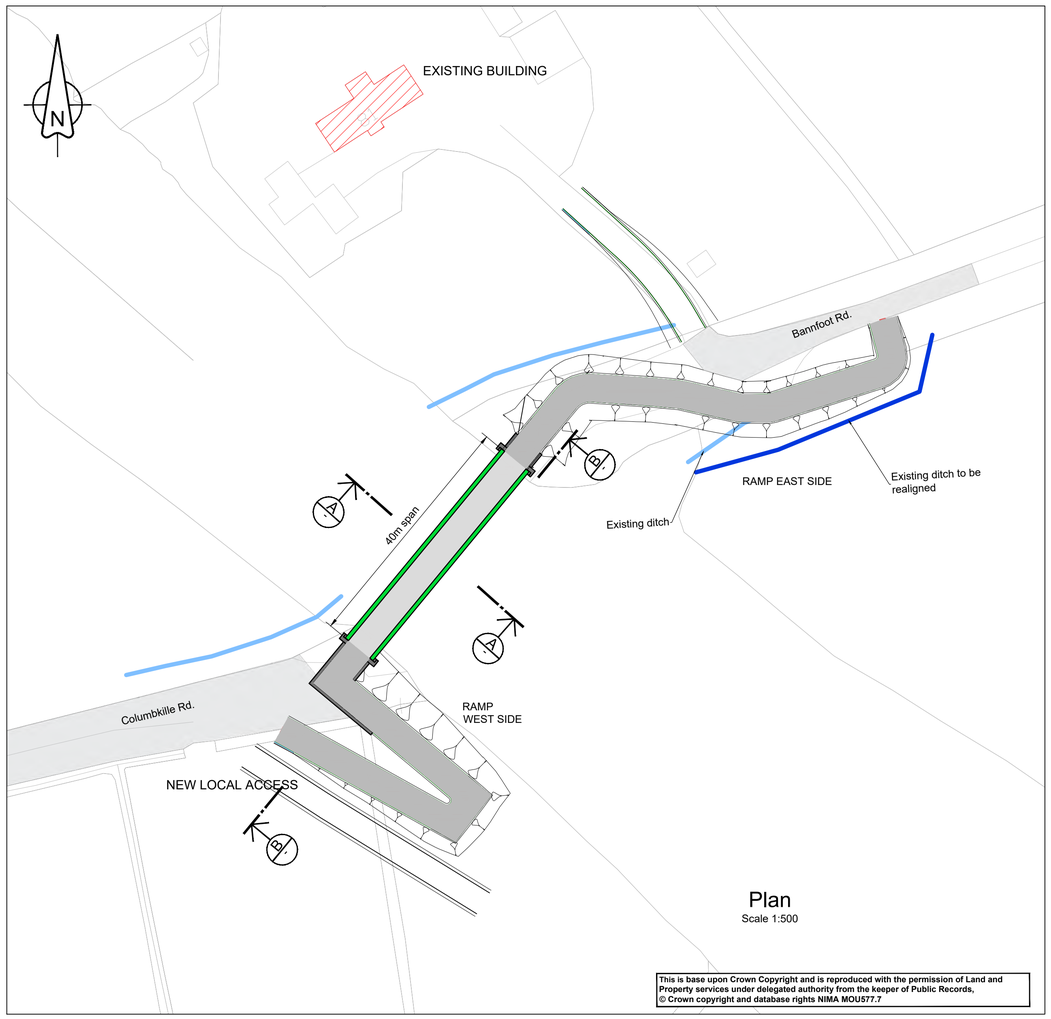
Project Name
Bannfoot Bridge Feasibility Study

Drawing Title
Option 1A - Pedestrian/Cycle Bridge - Warren Truss

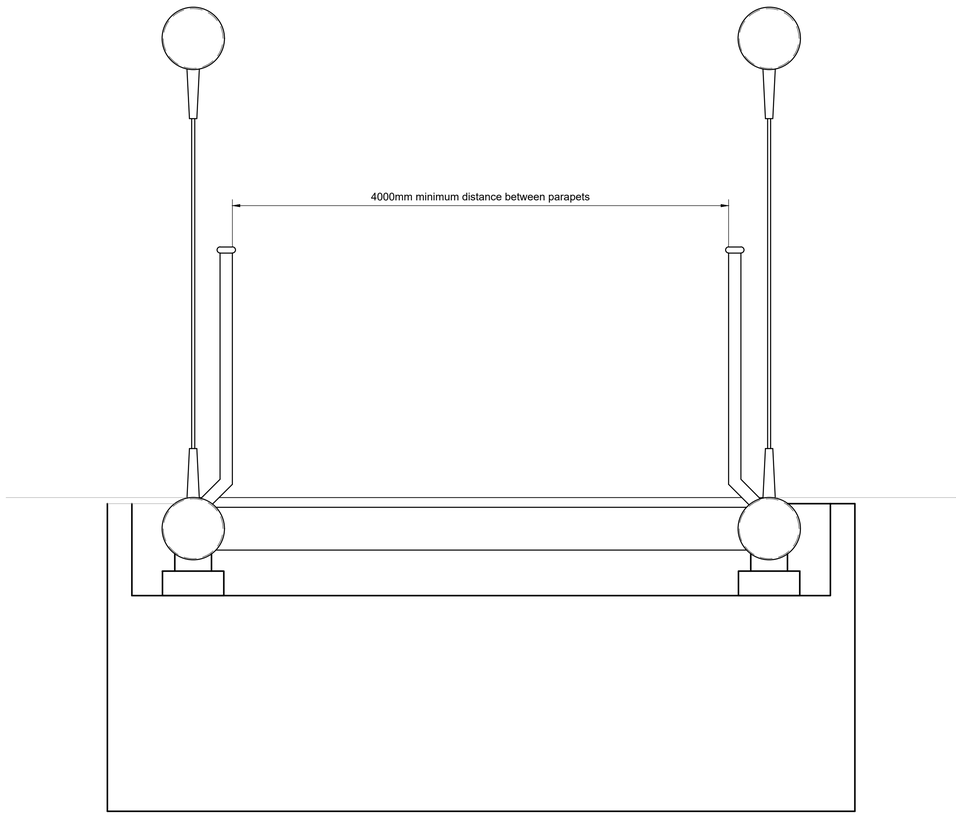
Original Drawing Size : A1	Scale : As Shown
Dimensions : -	

Drawing Status	Suitability
SUITABLE FOR INFORMATION	S2

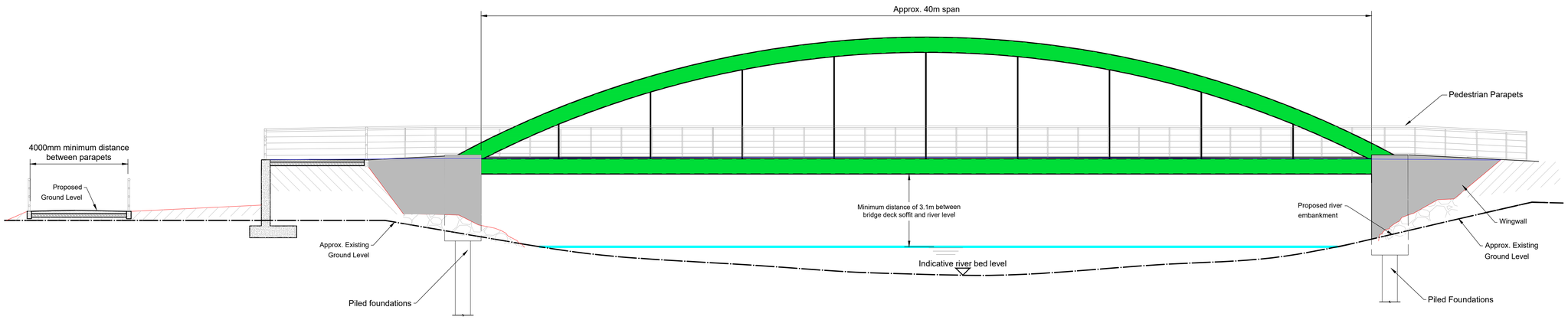
Drawing No	Rev
C0402126-AMEY-SBR-XX-DR-CB-000001	P01



Plan
Scale 1:500



Section A-A
Scale 1:25



Elevation B-B
Scale 1:100

NOTES

1. All dimensions in millimetres unless otherwise stated.
2. This drawing is to be read in conjunction with the drawing series CO402126-AMEY...
3. Do not scale from this drawing - use only values of stated dimensions.
4. Site extents are approximate

KEY

- Existing River Bed / Ground Level
- Existing River Level
- Existing ditch
- Realigned ditch

Rev	Revision details	Drwn	Chkd	Appd	Date

Designed:		Date: 10/01/2023
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Snr Tech Check:		Date: 26/01/2023
Checked:		Date: 20/01/2023
Approved:		Date: 01/02/2023

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Project Name

Bannfoot Bridge Feasibility Study

Drawing Title

Option 1B - Pedestrian/Cycle Bridge - Tied Arch

Original Drawing Size : A1	Scale : As Shown
Dimensions : -	

Drawing Status	Suitability
SUITABLE FOR INFORMATION	S2

Drawing No	Rev
C0402126-AMEY-SBR-XX-DR-CB-000002	P01

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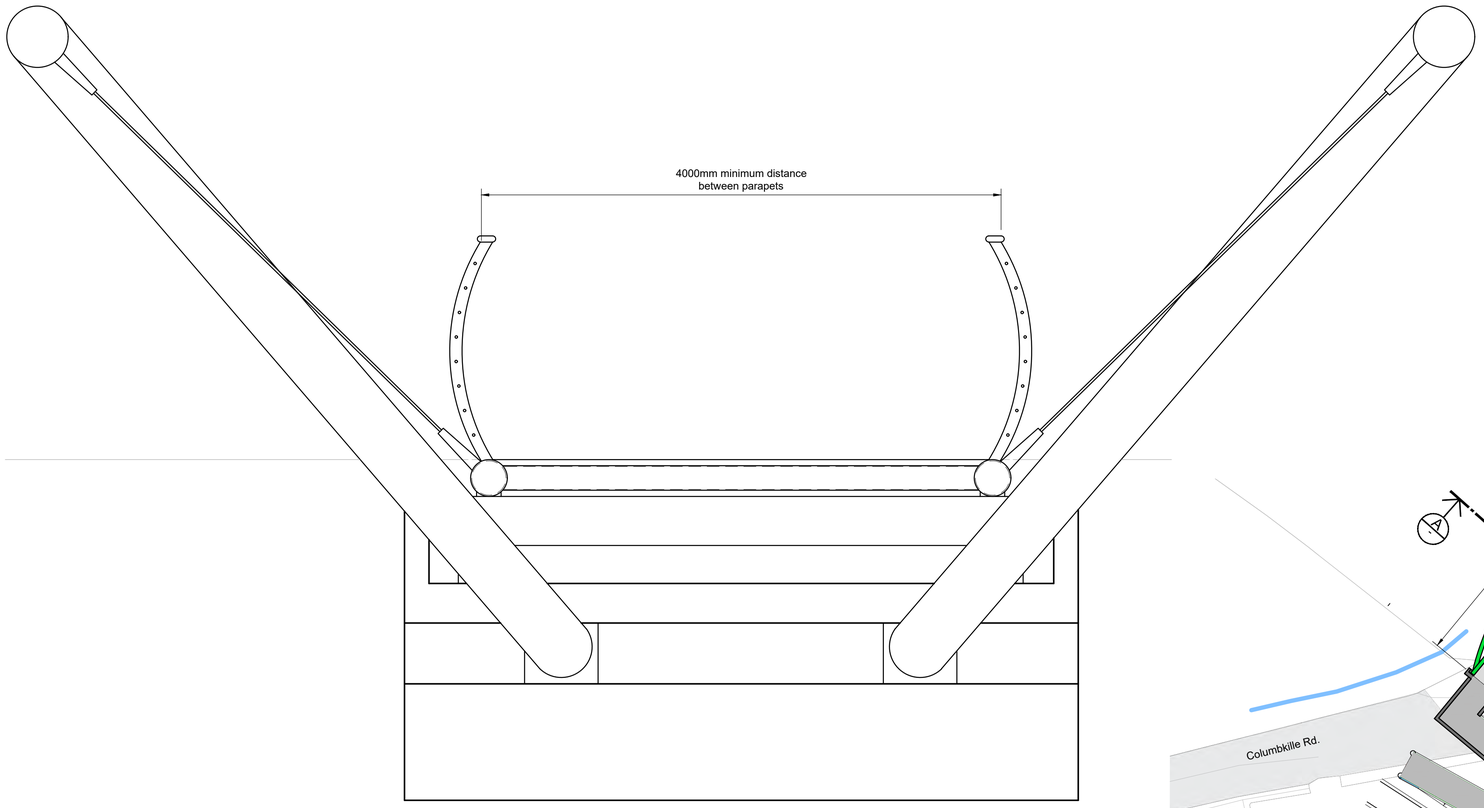

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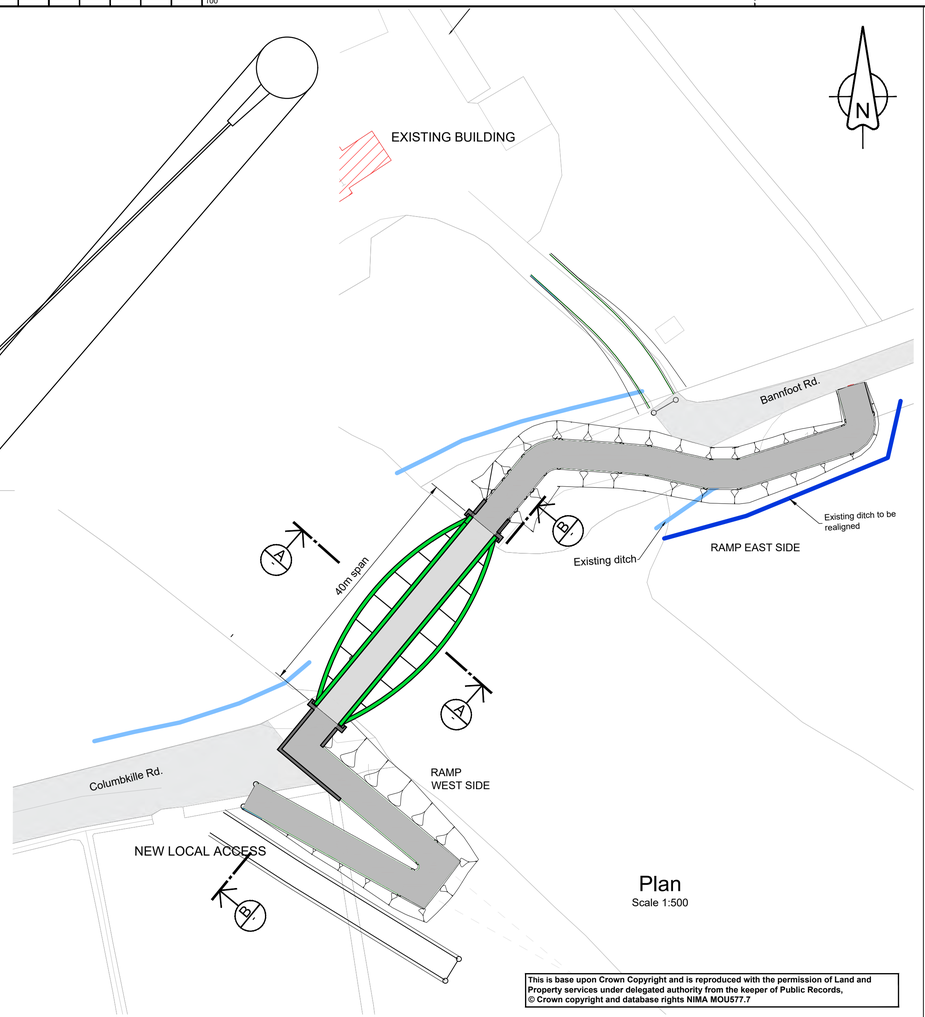
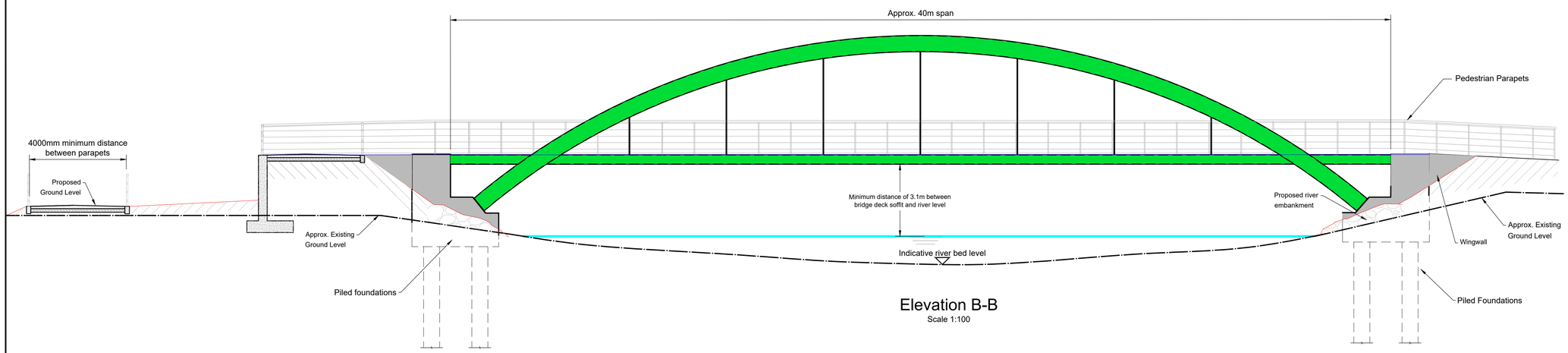


Plan
Scale 1:500



Elevation B-B
Scale 1:100

NOTES

1. All dimensions in millimetres unless otherwise stated.
2. This drawing is to be read in conjunction with the drawing series CO402126-AMEY...
3. Do not scale from this drawing - use only values of stated dimensions.
4. Site extents are approximate

KEY

- Existing River Bed / Ground Level
- Existing River Level
- Existing ditch
- Realigned ditch

Rev	Revision details	Drwn	Chkd	Appd	Date

Designed:	Date:	10/01/2023
Drawn:	Date:	20/01/2023
Snr Tech Check:	Date:	26/01/2023
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Approved:	Date:	01/02/2023

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Project Name
Bannfoot Bridge Feasibility Study

Drawing Title
Option 1C - Pedestrian/Cycle Bridge - Butterfly Arch

Original Drawing Size : A1	Scale : As Shown
Dimensions : -	

Drawing Status	Suitability
SUITABLE FOR INFORMATION	S2

Drawing No	Rev
C0402126-AMEY-SBR-XX-DR-CB-000003	P01

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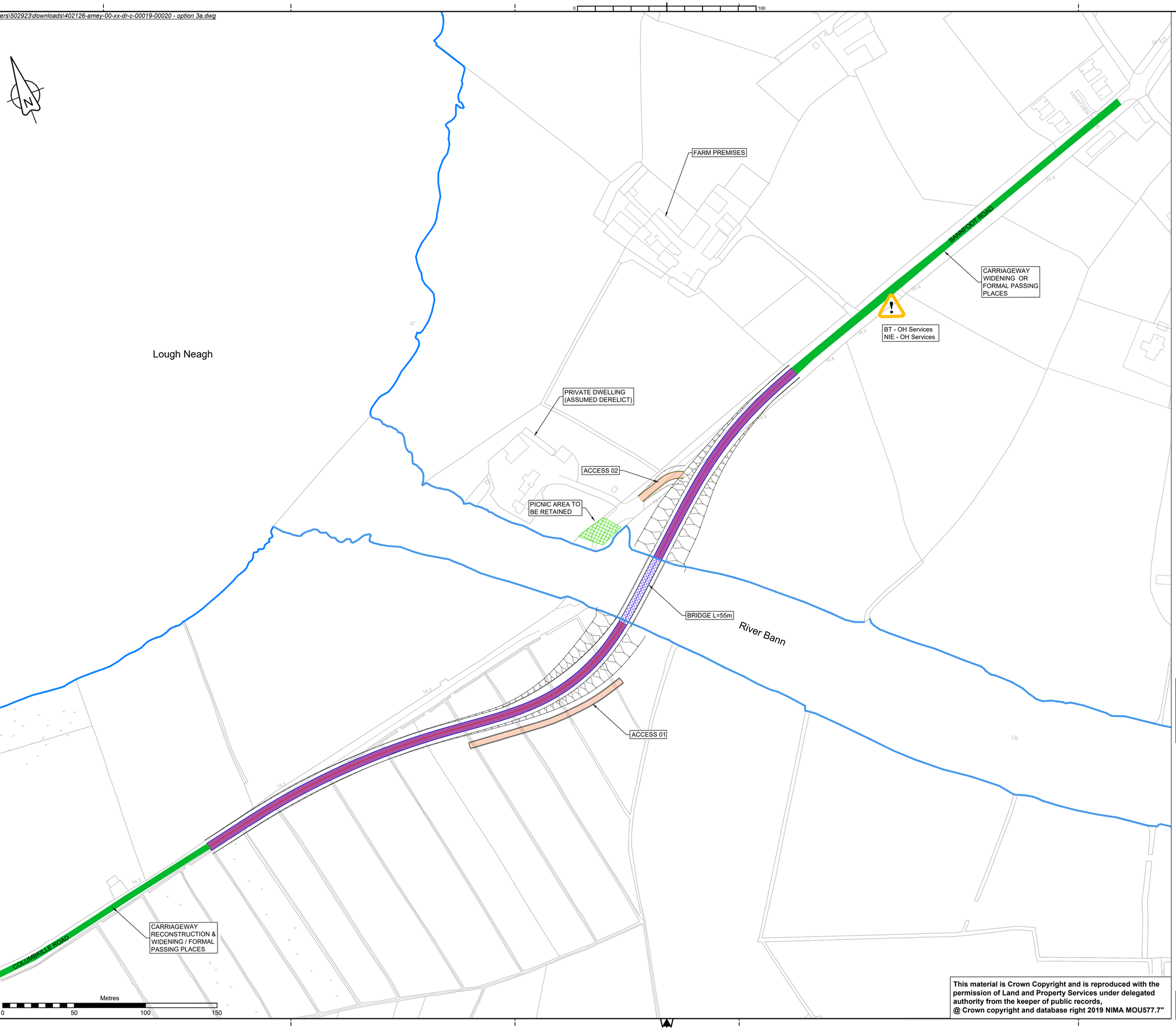

NOTES

1. All dimensions are in meters unless stated otherwise.
2. Existing levels have been taken from OS mapping/Northern Ireland topographical map and are in meters above ordnance datum.

- Road bridge option proposed (Span = 55m)
- Proposed ramps
- Proposed realigned access
- Carriageway widening or formal passing places
- River Bann
- Proposed HB2 kerbs
- Proposed ramp profile A. Refer to drawing 402126-AMEY-00-XX-DR-C-00020.
- Proposed ramp profile B. Refer to drawing 402126-AMEY-00-XX-DR-C-00020

Rev	Revision details	Drwn	Chkd	Appd	Date

Designed:		Date: 21/12/2022
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Project Name
Bannfoot Bridge Feasibility Study

Drawing Title
Proposed Road Bridge
Sheet 1 of 2

Original Drawing Size : A1	Scale : 1:1000m
Dimensions : -	

Drawing Status	Suitability
SUITABLE FOR INFORMATION	S2

Drawing No	Rev
402126-AMEY-00-XX-DR-C-00019	P01

File ref - c:\users\502923\downloads\402126-amey-00-xx-dr-c-00019-00020 - option 3a.dwg

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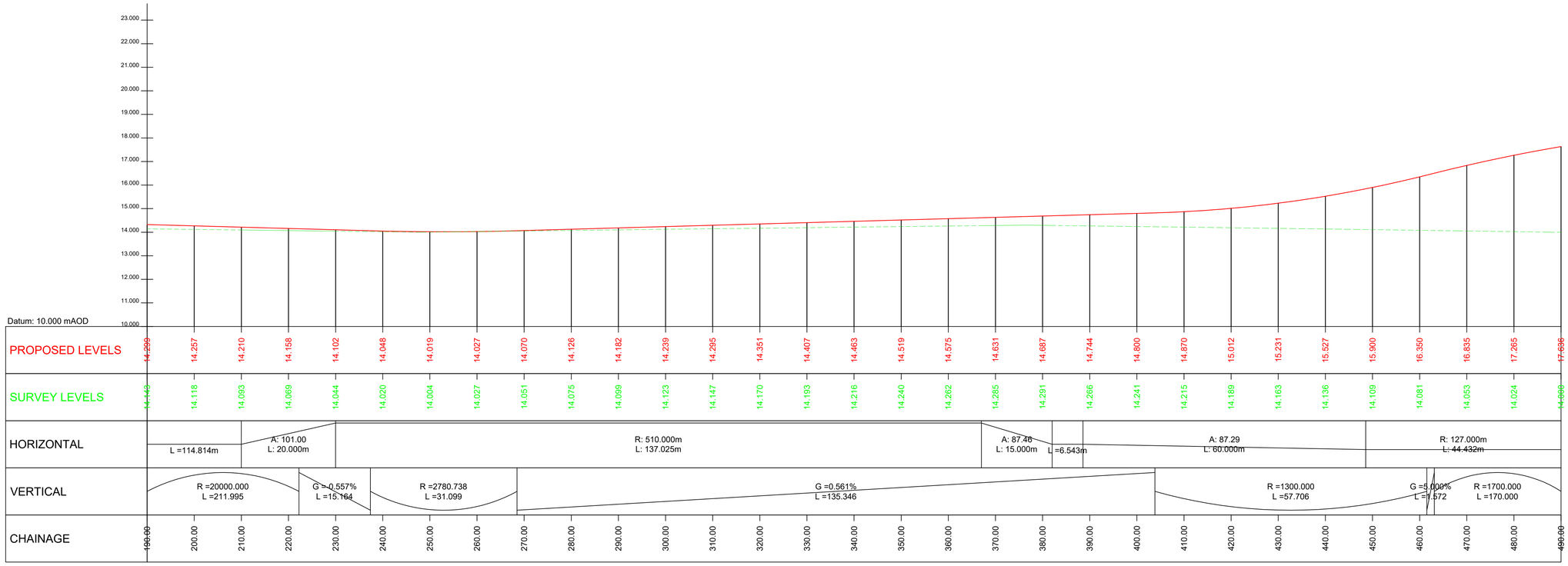

RAMP PROFILE A - LONGSECTION
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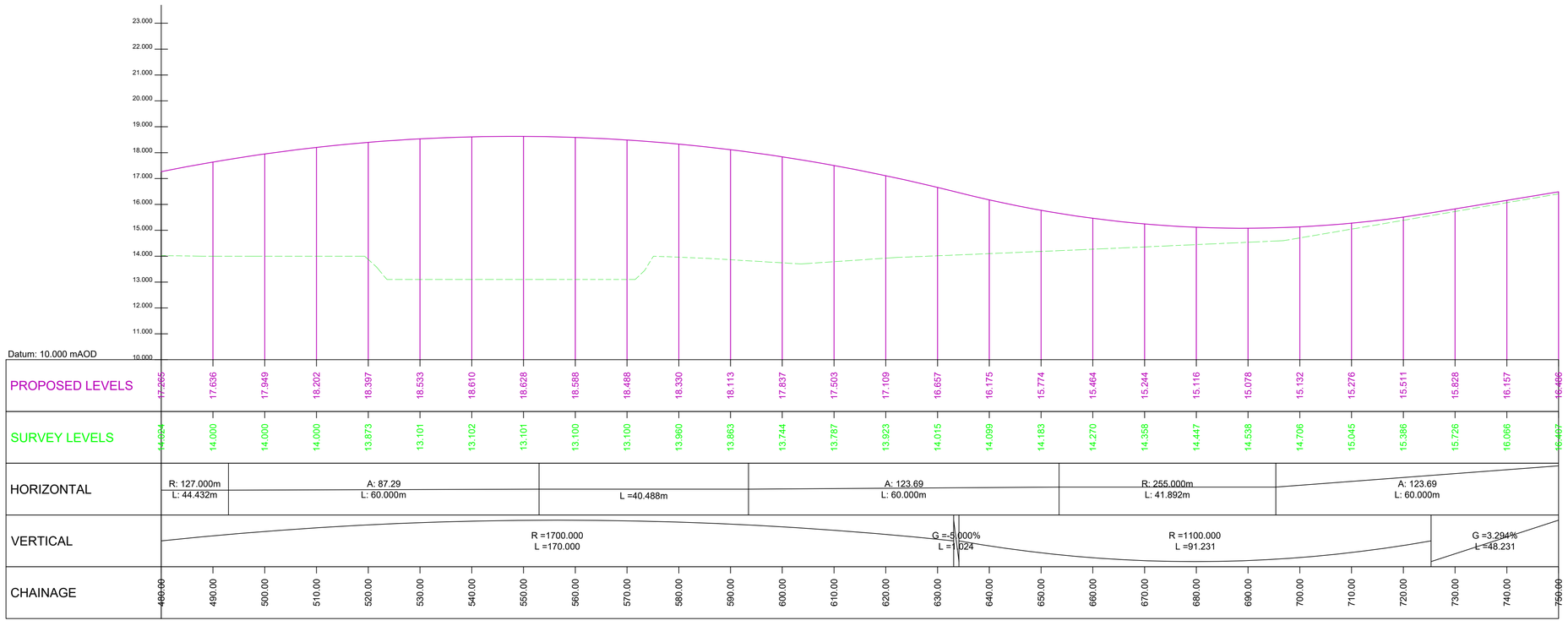

RAMP PROFILE B - LONGSECTION
SCALE: H 1:500,V 1:100.

KEY

- Existing profile
- Proposed ramp profile A. (Columbkille Road ramp)
- Proposed Bannfoot Road ramp and bridge deck

Rev	Revision details	Drwn	Chkd	Appd	Date

Designed:		Date: 21/12/2022
Drawn:		Date: 17/01/2023
Snr Tech Check:	.	Date: .
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Approved:		Date: 01/02/2023

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Project Name
Bannfoot Bridge Feasibility Study

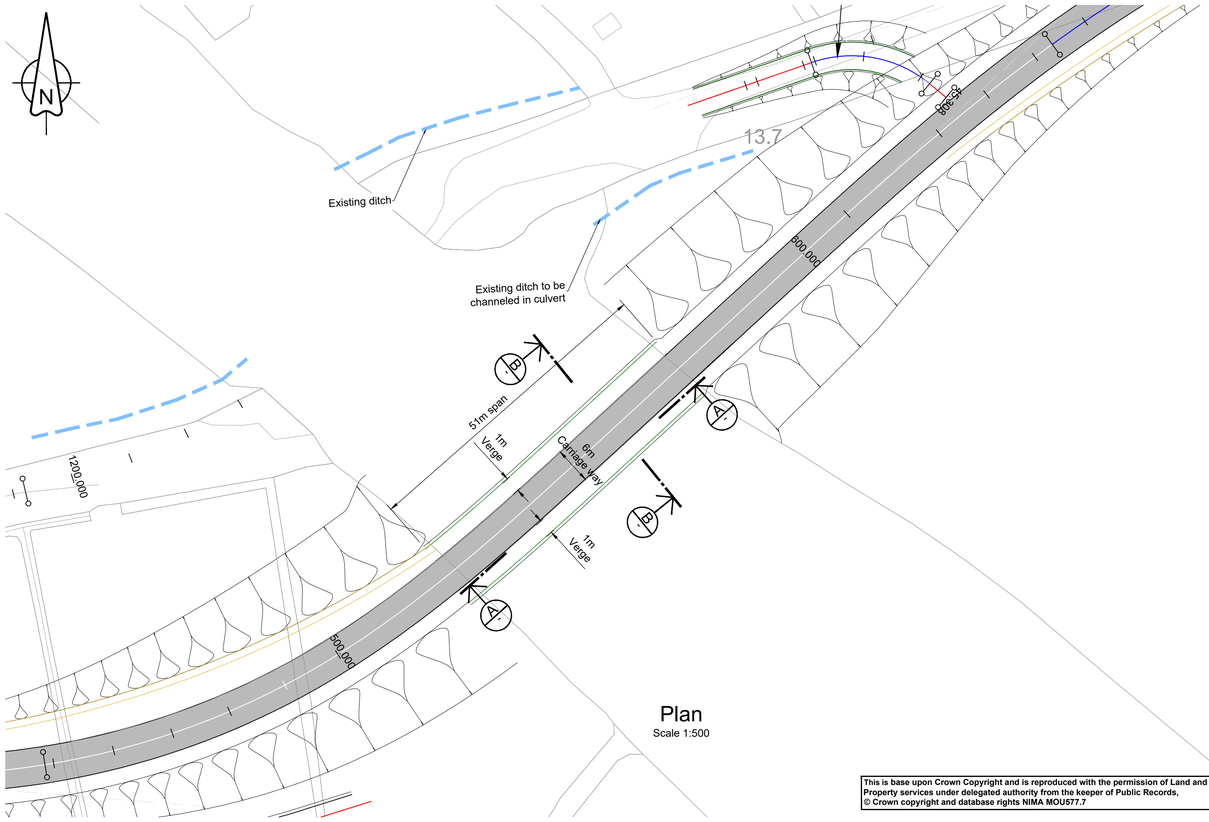
Drawing Title
Proposed Road Bridge
Long sections
Sheet 2 of 2

Original Drawing Size : A1	Scale : 1:500
Dimensions : -	

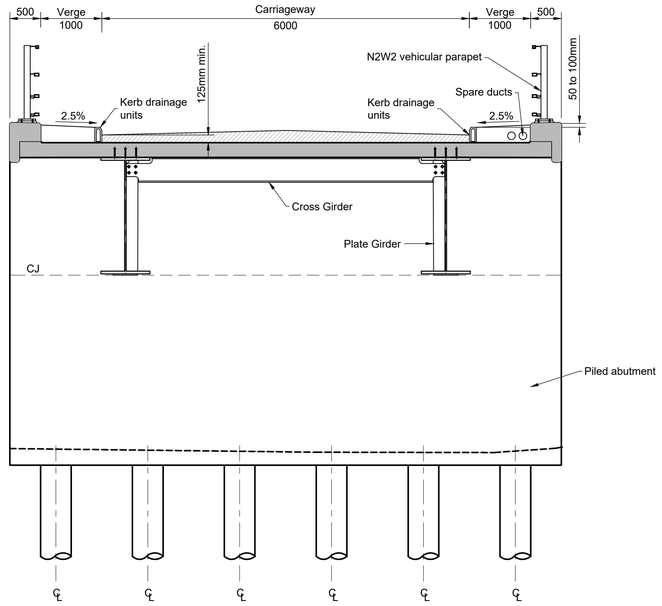
Drawing Status	Suitability
SUITABLE FOR INFORMATION	S2

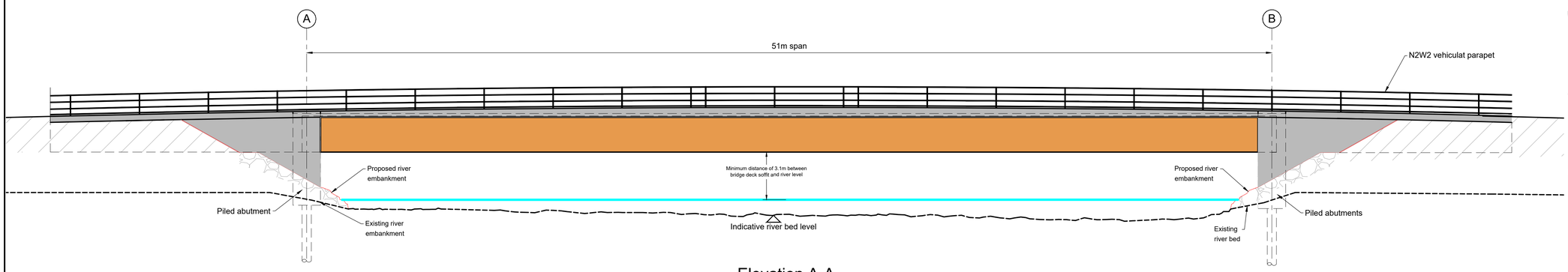
Drawing No	Rev
402126-AMEY-00-XX-DR-C-00020	P01

File ref - g:\1 active\coni05 south\co402126 - bannfoot bridge feasibility study\07 cad\g. work area\1. live drgs\structures feasibility opt\co402126-amey-sbr-xx-dr-cb-00001 - road bridge ga.dwg



Plan
Scale 1:500





Elevation A-A
Scale 1:125

NOTES
1. All dimensions are in millimetres unless otherwise specified.
2. Levels are approximate to ordenance survey datum.
3. Do not scale from this drawing - use only values of stated dimensions.

KEY
- Existing River Bed / Ground Level
- Existing River Level
- Existing ditch

Rev	Revision details	Drwn	Chkd	Appd	Date

Designed:	Date:	10/01/2023
Drawn:	Date:	10/01/2023
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Approved:	Date:	01/02/2023

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Project Name
Bannfoot Bridge Feasibility Study

Drawing Title
Option 2 - Road Bridge

Original Drawing Size : A1	Scale : As Shown
Dimensions : -	

Drawing Status	Suitability
SUITABLE FOR INFORMATION	S2

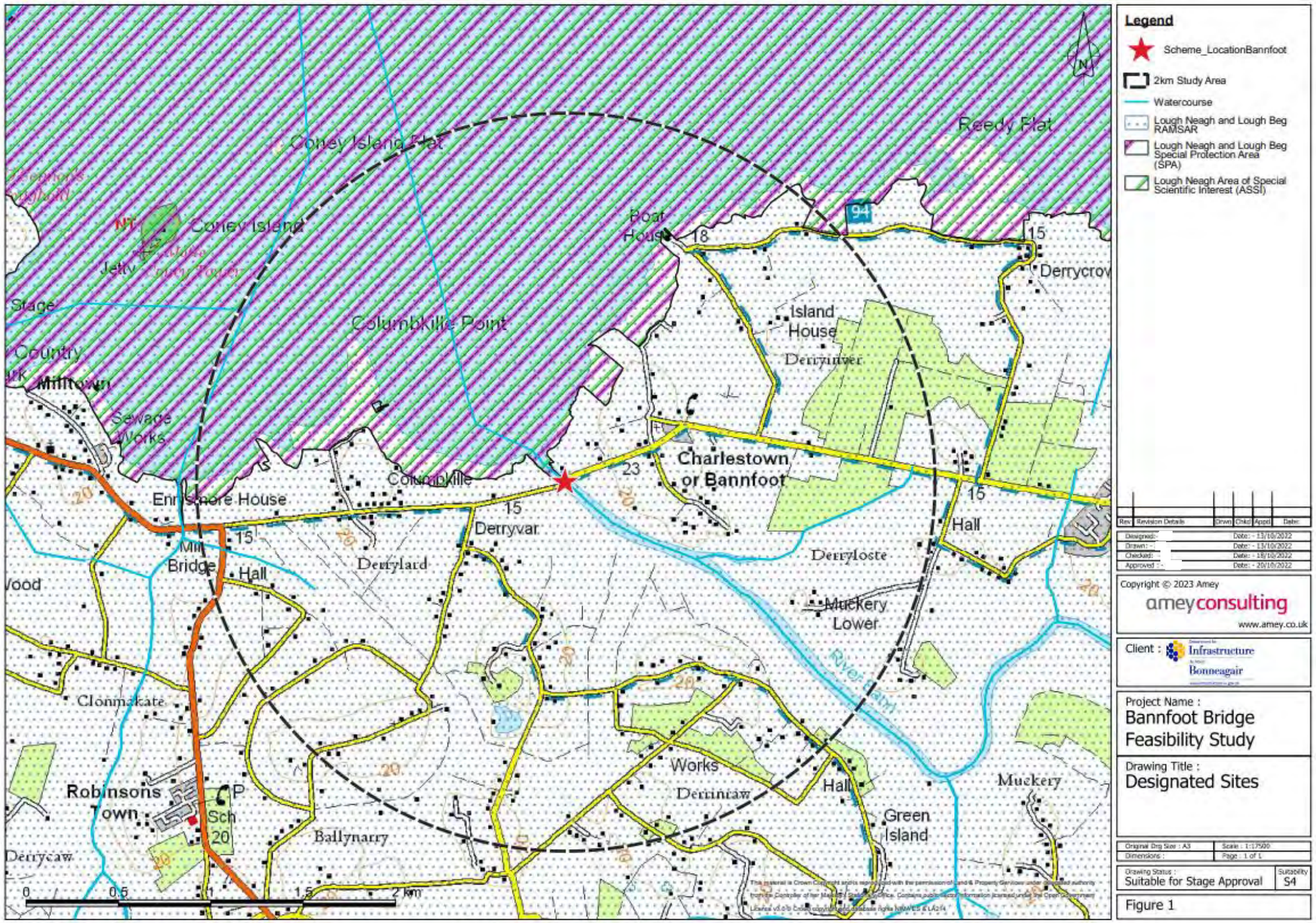
Drawing No	Rev
CO402124-AMEY-SBR-XX-DR-CB-000004	P01

Appendix B: Environmental Constraints Drawings

Appendix B-1 : Designated sites within 2km of site

Appendix B-2 : Environmental constraints within 300m of sites

Appendix B-1 : Designated sites within 2km of site



Appendix B-2 : Environmental constraints within 2km of site

Appendix C: C2 Service Information

Appendix C-1 : Openreach map

Appendix C-2 : Fibrus map

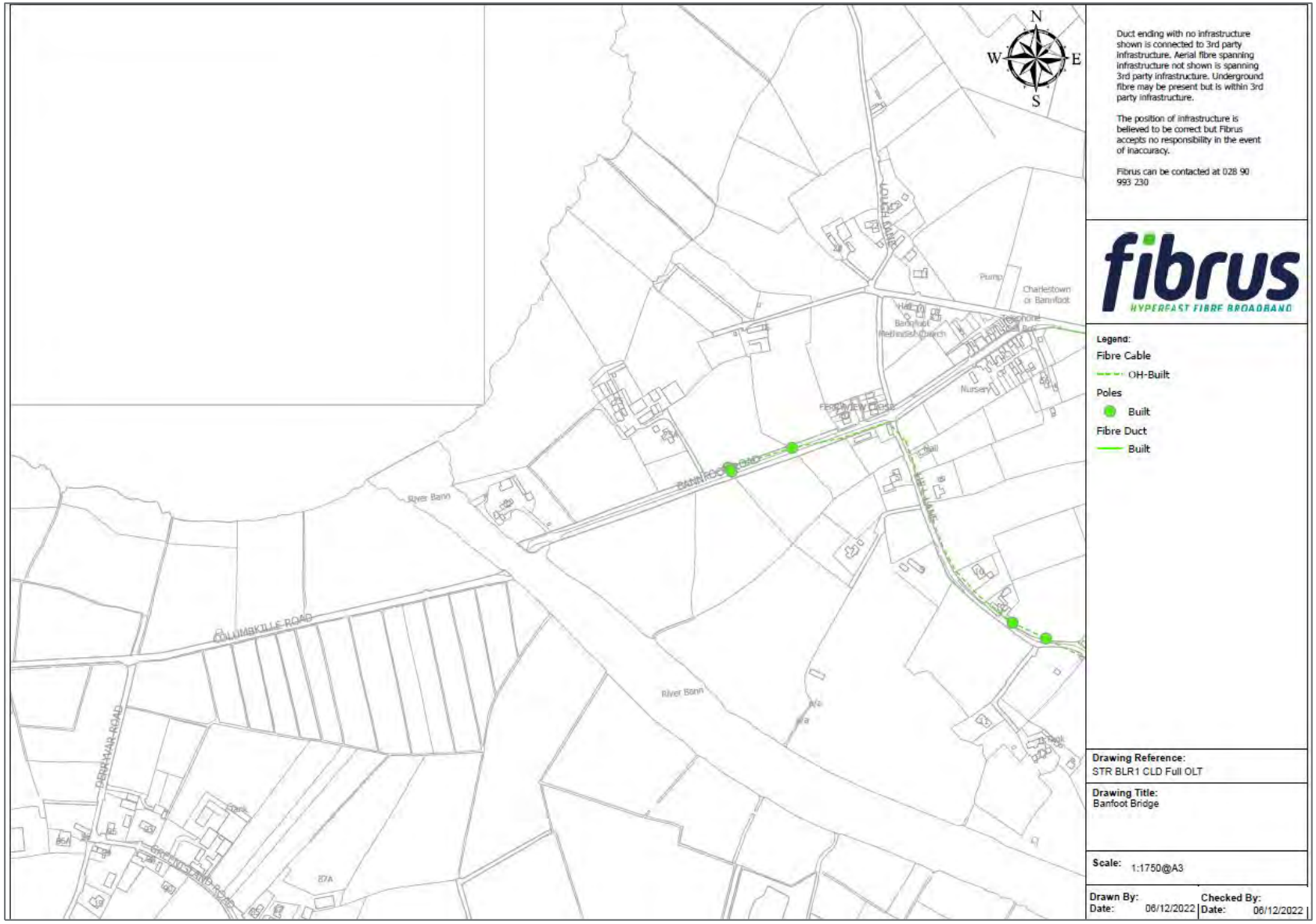
Appendix C-3 – NIE map

Appendix C-4 : NIW map

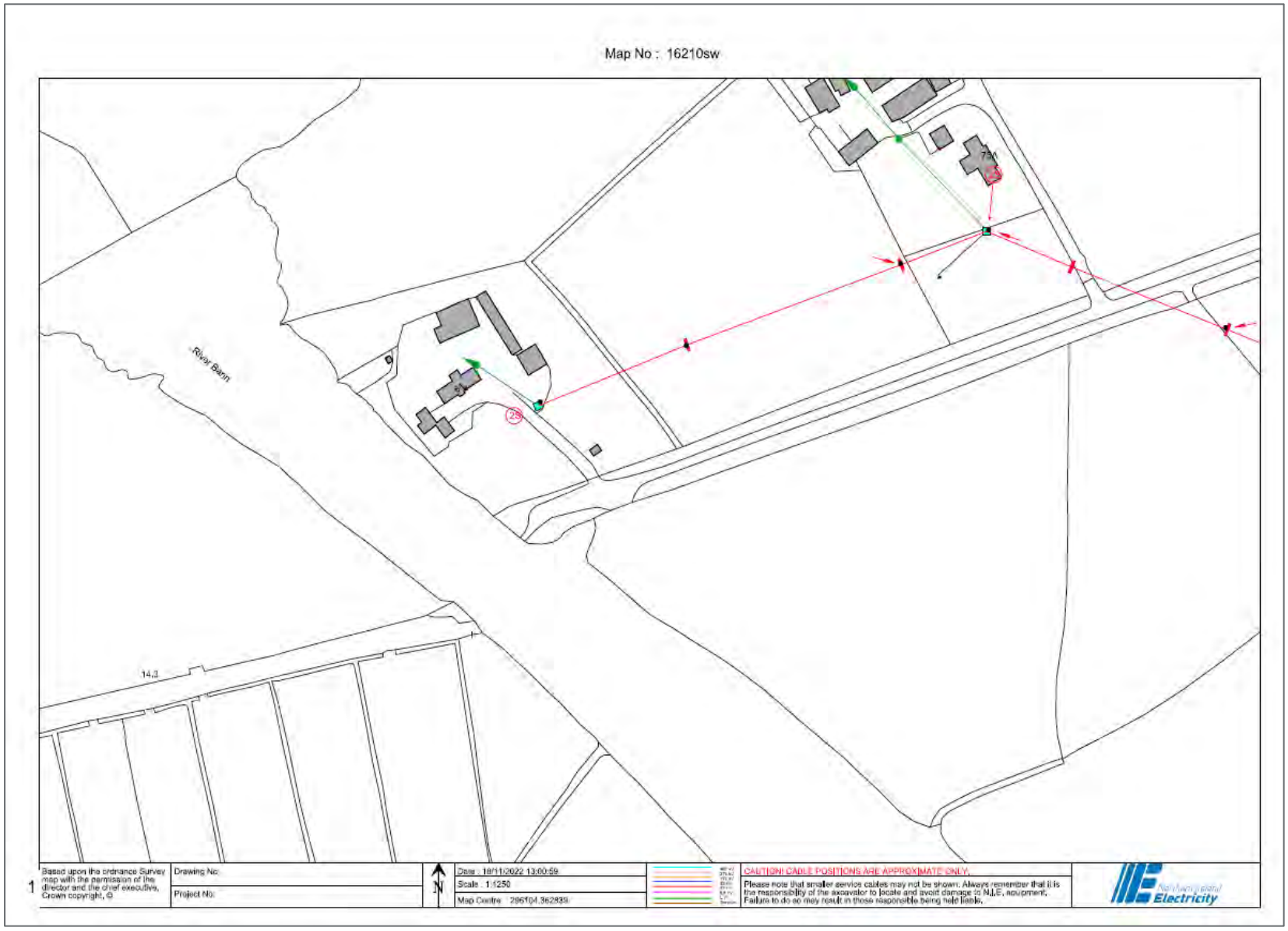
Appendix C-5 : DFI Rivers map

Appendix C-1 : Openreach Service Map

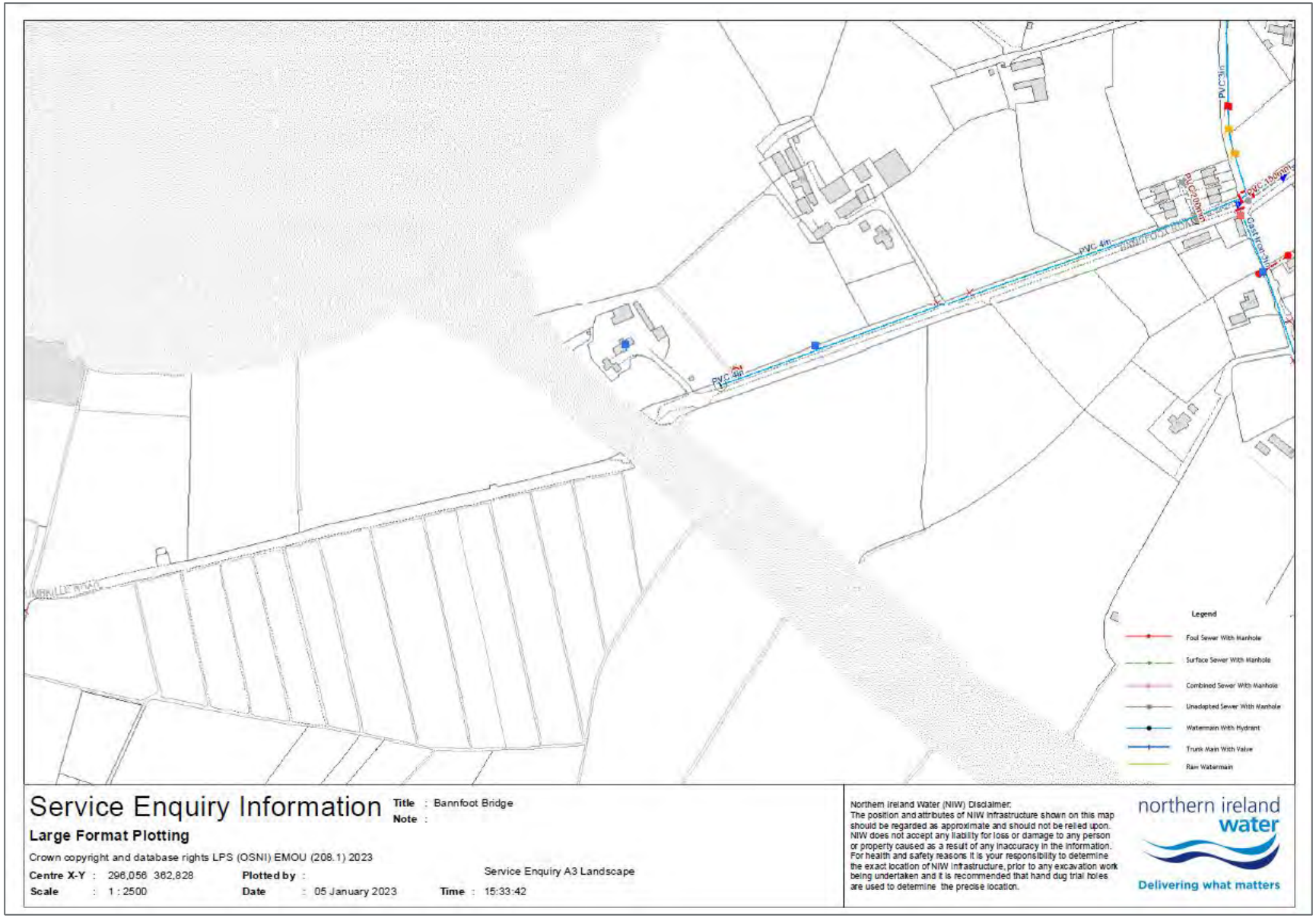
Appendix C-2 : Fibrus Service Map



Appendix C-3 : NIE Service Map



Appendix C-4 : NIW Service Map



Appendix C-5 :DFI Rivers Map