BEARA BREIFNE WAY TRAIL PLAN
Technical Trail Audit and Design

Section A - Construction Standards

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Prepared by Outdoor Recreation NI

on behalf of Fáilte Ireland

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Fáilte Ireland

OUTDOOR RECREATION NORTHERN IRELAND

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FOREWORD

This document includes audit and series of recommendations for the Beara Breifne Way carried out by Outdoor Recreation NI and funded by Fáilte Ireland.

Outdoor Recreation NI is not affiliated with Fáilte Ireland or any of the stakeholders involved in this study.

The findings in this report are based on information gathered specifically for this project through desktop research, fieldwork and consultation and analysed in the context of best practice models and over 20 years of knowledge and experience working in the outdoor recreation sector.

The recommendations made in this report are the independent, professional opinion of Outdoor Recreation NI alone and represent what it deems to be the best way forward for the future development and management of the Beara Breifne Way.

We wish to acknowledge the support of landowners in development of the trail to date. **Recommendations made within this report** are dependent on **the** continued **support and permissions of multiple landowners along the route.**

1 INTRODUCTION

Outdoor Recreation NI (ORNI) was commissioned in December 2020 by Fáilte Ireland to complete a Trail Audit and Design for the Beara Breifne Way (hereinafter referred to as BBW).

1.1 Objective and Scope

The primary objective is to guide future investments and developments to ensure the BBW realises its potential as an internationally compelling visitor experience.

'It is the aim that the BBW becomes a long-distance walk of international significance as well as a soft product for the masses to explore nature and cultural experiences.'

The project team was tasked with carrying out the necessary steps to allow the developer or Local Authority to take their section of the BBW to the relevant consent process. Project elements therefore included:

1. Conducting a technical trail audit to include detailed trail design and build specifications to include:
    - Detailed inspection of the existing trail in terms of trail type, surface, trail features, trail infrastructure
    - Detailed recommendations for the trail in terms of new build, upgrade, re-route, no work required - including linkages to towns, villages and attractions
    - Detailed design of the trail and prioritise delivery sections in line with recommendations set out in the Tourism Masterplan for the BBW

In addition to this, several other key project elements are also required to allow the project to be brought to a state of readiness:

2. Develop an Interpretation Framework for the route to:
    - Engage the walker and to ensure a compelling visitor experience along the trail
    - Review existing branding and develop a new logo and tagline for the BBW
    - Design a suite of interpretation hardware and trail furniture for installation along the BBW
    - Design an Interpretation Toolkit and Interpretation Guidelines for third party usage along the trail
    - Identify Signature points and existing and potential Viewpoints, that include the start

and end point and key points along the trail
    - Develop a Waymarking Strategy
    - Develop a Visitor Orientation Strategy.
3. Carry out all required Environmental Assessments where required.
4. Carry out all required Built Heritage Assessments where required.

This document (Sections A-D) focuses on tasks summarised in Section 1. above: 'Technical Trail Audit' and contributes to the wider BBW Trail Plan.

1.2 Methodology

The methodology for the technical trail audit and design comprised the following key actions:

- Desk research including extensive mapping
- Working with project ecologists Woodrow Sustainable Solutions, and project planning consultants, Braniff Associates, on the development of an Environmental Sensitivities and Opportunities Review (ESOR) to provide high-level ecological constraints and biodiversity enhancement opportunities along the proposed route
- Consultation on the findings of the ESOR summary when considering alternatives for reroutes for the trail
- Review of the ESOR summary and Masterplan to inform the Strategic Environmental Assessment (SEA) for this proposal
- One-to-one consultation with key stakeholders for component trail sections
- Extensive fieldwork along the route of the BBW
- Post audit consultation with consultant upland trail specialist
- Post audit consultation with project ecologists Woodrow Sustainable Solutions and project planning consultants Braniff Associates to assess audit findings and potential impacts of proposed construction techniques
- Development and refinement of trail design including proposed construction techniques
- QS costing of recommendations.

A detailed methodology for the Technical Trail Audit is detailed in Section **Error! Reference source not found.** Audit Methodology.

1.3 Statement of Approach

In determining recommendations, the project team have tried to achieve an appropriate balance between reactive and proactive approaches to path works. Traditional path works, particularly in upland settings, tend to favour a reactive response, only intervening when absolutely required to respond to current and emerging issues such as significant erosion. The remit of this project is to identify works required to elevate the existing trail standard to become a '*long-distance walk of international significance'.* To achieve international significance the route must be capable of sustaining high footfall. As such we have responsibility to consider proactive interventions able to support high footfall in sections with high visitor appeal. Recommendations have therefore been made that focus on protecting surrounding habitats through restricting footfall to a clearly defined and built trail surface that can support it.

Throughout, trail works should strive to minimise visual impact on the landscape yet provide durable surfaces. The aim should always be to build or repair using techniques capable of withstanding the pressures of both path users and climates, but without detracting from the experience of walking through wild and natural landscapes.

It will be imperative moving forward that all key stakeholders adopt this approach in future developments.

Proactive vs Reactive approaches to trail build are explored in more detail in Section 2.10.

We wish to acknowledge the support of landowners in development of the trail to date. **Recommendations made within this report** are dependent on **the** continued **support and permissions of multiple landowners along the route.**

2 BEARA BREIFNE WAY DEVELOPEMENT

The following section looks at work undertaken to date, work in progress and proposed works moving forwards for development of the BBW. The section comprises:

Section	Content
2.2	Study Area
2.3	Vision for the BBW
2.3	Development of the BBW
2.4	Ongoing Trail Development Process
2.5	Funding for Development Works
2.6	Trail Management and Governance
2.7	Environmental and Planning Reporting
2.8	Project Development – Project Management and Contracting of Construction Work
2.9	Path Development Principles in 'Remote rural/Upland' Areas
2.10	Trail Build – Workforce Constraints and Opportunities

2.1 Study Area

The study area covers the route of the existing BBW which stretches from Dursey Island in Co Cork to Blacklion in Co Cavan. It runs for over 700km and traverses the counties of Cork, Kerry, Limerick, Tipperary, Offaly, Galway, Roscommon, Sligo, Leitrim and Cavan connecting a series of rural communities along the route. The BBW is made up of twelve existing National Waymarked Ways (NWTs) or long-distance walking routes and sections of trail that link these.

2.2 Vision

2.2.1 Fáilte Ireland Vision

Fáilte Ireland's vision is for Ireland to be recognised internationally as a world class, year-round activity destination by 2028. In order to achieve this vision, Ireland must increase the range and availability of outdoor tourism and recreation infrastructure, and significantly enhance the visitor experience while they engage and participate in Outdoor Activities. Outdoor Activities have been identified as a key

element in the current Fáilte Ireland strategy under the 'Building Brilliant Visitor Experiences' strategic pillar.

Another key objective of Fáilte Ireland is creating more regional spread of visitors across Ireland and increasing the economic contribution of tourism in local communities. The BBW passes through many non-traditional tourism areas. Fáilte Ireland believes it can provide the 'hook' in local communities on which to develop experiences and services, driving economic benefit to these areas.

2.2.2 Ambitions of route

The BBW runs through three of Ireland's regional experience brand areas: Ireland's Hidden Heartlands, Wild Atlantic Way and Ireland's Ancient East. However, the trail has been identified as one of the Signature Experiences of Ireland's Hidden Heartlands (alongside the Shannon Navigation), therefore, it should be most closely aligned to the key objectives of Ireland's Hidden Heartlands. The trail will become a framework around which to cluster a range of engaging visitor experiences therefore effecting visitor spread and increasing visitor dwell time and delivering the proposition of Ireland's Hidden Heartlands. It is the aim that the BBW becomes a long-distance walk of international significance as well as a soft product for the masses to explore nature and cultural experiences.

2.3 Development of the BBW

The BBW is a unique grass-roots community-led initiative and is the largest community-based project undertaken in Ireland. Its development has been supported by a large number of stakeholders since 2001 including, The Heritage Council, Fáilte Ireland and the Local Authorities along the trail (Cork County Council, Kerry County Council, Limerick County Council, Tipperary County Council, Offaly County Council, Galway County Council, Roscommon County Council, Leitrim County Council, Sligo County Council and Cavan County Council).

The Beara Tourism and Development Association has championed and driven this project over the past 17 years, and 12 community groups have signed an MOU to ensure continuity amongst themselves as the drivers of the trail development. Significant efforts have been made by the National Waymarked Way committees and local communities to develop the BBW.

In 2019, Fáilte Ireland commissioned the development of a Tourism Masterplan to guide future investments and developments to ensure the BBW realises its potential as an internationally compelling visitor experience.

A multi-disciplinary team was procured in December 2020 to develop the 'Beara Breifne Way Trail Plan' to carry out the necessary steps to take the BBW towards relevant consent process. This report focusses on findings specific to the trail audit and recommended trail design element of this wider project.

2.4 Ongoing Trail Development Process

Given the length of the trail and the scope of works required it is likely that development works along the BBW will be undertaken on a piecemeal basis, delivered through multiple contracts.

Whilst it might seem preferable to undertake the capital works in its entirety to ensure consistency, realistically this would not be achievable due to multiple considerations including:

- Limited contractor and skilled workforce capacity
- Extensive geographical spread of the project
- Complex and lengthy planning process
- Specialist approaches required in some areas
- High level of funding required to undertake all works.

This report has been prepared assuming a phased approach to development, and the recommendations within are therefore provided to ensure a consistent approach is taken.

2.4.1 Approach to 'Remote/Upland' Sections

It is recommended that ongoing development is separated out into general trail works, and 'Remote rural/Upland' sections, and that the approach to the latter - in terms of trail development, contracted works for detailed design and construction, and ongoing maintenance - is handled with additional sensitivity. This is addressed further in sections 2.9.2.2 and 2.10.

2.5 Funding for Development Works

Section C (Technical Supplement and Costs) provides Quantity Surveyed (QS) costed recommendations for all works deemed required on the BBW to enhance the quality of the existing trail to 'international' standard. This is broken down into sub-categories for each of the 12 NWTs. Accompanying datasheets in the Technical Supplement and GIS shapefiles will provide supplementary information that will allow trail committees, relevant Local Authorities or Local Development Companies and Rural Recreation Officers (RROs) to assess the funding requirement for their sections. It is understood Fáilte Ireland is in ongoing discussions with relevant Departments and trail committee representatives to identify potential funding opportunities that will enable development works to proceed. It is recommended that in addition, these discussions consider ongoing trail management and governance, as this will

determine roles and responsibilities for funding, development works, management and maintenance moving forward. See Section 2.6 below.

2.6 Trail Management and Governance

The BBW Tourism Masterplan (2019) looked in detail at existing and proposed trail management and governance on the BBW.

In summary, all development, trail management and governance to date has been managed by Jim O'Sullivan. Jim is a member of the Beara Tourism and Development Association and, in a voluntary capacity, has successfully led the BBW to its current position. In doing so he has coordinated the representation from the 12 Waymarked trails.

The 2019 Masterplan outlined potential governance structure options for the BBW. It also recommended that further investigation and consultation with stakeholders takes place before a decision is taken on the most appropriate governance structure.

There is still a requirement to establish a more consistent committee structure across all trails to ensure equal focus across the entire length of the BBW and strong community involvement.

It is recommended that further to completion of this project this is addressed through consultation with multiple stakeholders including but not limited to: Fáilte Ireland, trail committees or individual trail representatives, local authorities, Local Development Companies, RROs.

2.7 Environmental and Planning Reporting

Given the nature and geographical extent of the BBW it is imperative that compliance with requirements under the SEA Directive, Habitats Directive and all related national regulation is considered. As part of the multi-disciplinary project team, planning consultants, Braniff Associates, and ecologists, Woodrow Sustainable Solutions, have worked together with the wider team on the development of:

- An Environmental Sensitivities and Opportunities Review (ESOR)
- Strategic Environmental Assessment (SEA)
- Appropriate Assessment (AA)

This work has followed the following process:

2.7.1 Environmental Sensitivities and Opportunities Review (ESOR)

Production of an Environmental Sensitivities and Opportunities Review report to provide a high-level outline of the ecological constraints and biodiversity enhancement opportunities which have been identified along the proposed route. Refer to supplementary ESOR and corresponding datasheet.

2.7.2 Strategic Environmental Assessment (SEA)

Having regard to the outcome of the (ESOR), all steps have been undertaken in order to satisfy in full the requirements of the SEA Directive 2001/42/EC and to S.I. 435/2004 - European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004. This includes a commitment to regularly monitor visitor numbers so that the trail can be used sustainably and the environment safeguarded.

2.7.3 Appropriate Assessment (AA)

Having regard to the outcome of the (ESOR), undertaking all required steps in order to satisfy in full the requirements the Habitats Directive 92/43/EEC and to SI No. 477/2011 -European Communities (Birds and Natural Habitats) Regulations 2011. This work is ongoing and will ensure all relevant deliverables as required in the AA process.

2.7.4 Planning Policy

2.7.4.1 National Planning Policy

The Trail Plan aligns with the National Planning Framework 2040, Project Ireland, in that it accords with three interrelated National Policy Objectives (NPOs). Firstly, it is intended to perform an economic role for rural areas in line with NPO 21. Secondly it will facilitate tourism development as per NPO 22. Thirdly, in keeping with NPO 46, it will enhance transport connectivity between NI and the ROI by encouraging active travel.

2.7.4.2 Regional Planning Policy

The Trail is located in the Southern Region and Northern and Western Region. The Regional Spatial and Economic Strategies (RSES) for these regions came into effect in 2020 and their Regional Planning Objectives (RPOs) reflect national policy objectives outlined in Project Ireland.

The RSES for the **Southern Region** contains RPO 53, relating to Tourism, which seeks to "*Sustainably develop walking and cycling trails…".* Furthermore, under RPO 201 relating to National Trails, Walking Routes, Greenway and Blueway Corridors, it states that "*It is an objective to support investment in the development of walking and cycling facilities……"*

It continues *"Local authorities and other public agencies shall seek to promote and support access to rural areas including upland areas, forestry, coastal areas and the development of existing walking routes, pilgrim paths, mountain trails and nature trails in conjunction with other public bodies, representative agencies and community groups and shall identify and protect existing paths, walkways and rights of way."*

Likewise, the Regional Spatial & Economic Strategy 2020 – 2032 (RSES) for the Northern and Western Region has similar RPOs. RPO 4.1 on Economy and Employment aims "*to support working with relevant landholders and recreational/tourism agencies to increase access to the countryside and our coastal areas…"* RPO 9.6 relating to tourism intends "*to establish a Cross-Jurisdictional Working Group which collaborates on projects such as Blueways, Greenways, Walking/Hiking Trails/Peatways to foster improved local and regional links."*

As a counterbalance to the pro development RPOs above, the RSES for the Northern and Western Region also outlines RPO 5.7 in respect of Natural Assets. It seeks to "*Ensure that all plans, projects and activities requiring consent arising from the RSES are subject to the relevant environmental assessment requirements including SEA, EIA and AA as appropriate."*

2.7.5 Environmental designations

Covering a distance of 707kms the 12 sections of this trail span 10 counties and largely proceed through areas of heath and bog. Due to the length of the existing trail it inevitably traverses environmentally sensitive areas relating to the natural and built environment. The trail directly intersects 13 Special Areas of Conservation (SACs), 6 Special Protection Areas (SPAs), 6 Natural Heritage Areas (NHAs) and 13 proposed Natural Heritage Areas (pNHAs). Eight of the pNHAs and one NHA, which are designations of national importance, generally overlap with the aforementioned SACs and SPAs, which are designations of European importance.

2.7.6 2.7.5 Critical infrastructure and transport planning

The consultation process underlined the importance of ensuring that adequate service infrastructure is in place to cater for the increased activity generated by the trail. This includes the requirement for adequate wastewater treatment facilities, as well as waste management services and drinking water supplies.

Attention was also drawn to the necessity for effective transport planning to minimise the use of the private car and promote sustainable travel modes. With this in mind, it is envisaged that shuttle bus services will be rolled out to transport users to trail heads and to transfer luggage between locations.

2.7.7 Additional Environmental Surveys Required

Ongoing works being undertaken by planning consultants Braniff Associates and ecologists Woodrow Sustainable Solutions (as outlined above) may identify the requirement for additional surveying works required pre-planning or pre-construction. These will be outlined in the final project plan. Additional survey works will be very specific to individual sites and may include flood risk assessments, topographical surveys, and protected species surveys as outlined below.

2.7.7.1 Protected species surveys

Protected species surveys may be required to support planning applications for works required on specific sections. Many animals and some plant species are legally protected and their presence on development projects can result in significant delays and increased costs.

Accredited ecologists may be required to survey for all of the major protected species (badgers, bats, dormice, great crested newts, otter, water vole and white-clawed crayfish).

2.7.7.2 Bat Survey

Bats and their roosting sites are fully protected under the UK and European law and it is an offence to kill, injure, capture, or disturb them, or to damage, destroy or obstruct access to their roosts.

Bat surveys of trees are mainly carried out from ground level and low-level ladders with the aid of binoculars. Surveys mainly focus on assessing the potential of the tree to support bats. Occasionally tree surveys will be undertaken using lifting platforms or by specialist licensed climbers so that the tree canopy can be inspected for evidence of bats.

The second stage of the bat survey is seasonally constrained and must be undertaken at a time when bats occupy summer roost sites. For building surveys, this is from May to August, and from May to September for tree surveys. The survey involves positioning observers around the building, tree or structure at dusk and/or dawn to determine if bats are emerging or re-entering the structure and using it as a roost. Ultrasound bat detectors are used during this work to assist with species identification.

If a proposed development will affect a bat roost, a European Protected Species Licence may be needed prior to the start of works. The licence application process requires the agreement of a method statement which will ensure that bats can continue to occupy the site after the development has been completed.

2.7.7.3 Badger Surveys

Badgers and their setts are protected under the Protection of Badgers Act 1992, which makes it illegal to kill, injure them or to interfere with a sett.

Badgers are often affected by development projects and a licence from the statutory agency is needed if work likely to cause disturbance to badgers is planned close to an active sett. Licences are also required for the exclusion, closure or destruction of a sett.

As long as the setts are not damaged**,** nor the badgers disturbed, many activities are permitted around them. These activities can include vegetation clearance and work with hand tools or machinery. However, the noise and vibration levels for such work must remain within the levels commonly tolerated by badgers.

Surveys can be undertaken throughout the year, although the period from October to April is most effective when vegetation cover is reduced, setts are readily visible and badgers are highly active.

When setts cannot be retained within a development site, the badgers must be excluded prior to sett destruction. This work can only be undertaken under licence and will only be permitted from July to November as the breeding season runs from December to June. Other mitigation can include the creation of foraging habitat and the installation of badger-proof fencing and tunnels to new or existing roads.

2.7.7.4 Great Crested Newt Survey

Great crested newts are fully protected under the UK and European law and are frequently encountered on development sites.

It is an offence to kill, capture, disturb them, or to damage or destroy their ponds. This protection extends to the habitats which support great crested newts and it is generally assumed that the species might be present in terrestrial habitats up to 500m from a breeding pond, depending on habitat quality, connectivity and population size.

Surveys for great crested newt are seasonally constrained to the period mid-March to mid-June when great crested newts are present in their breeding ponds. Outside of this season terrestrial surveys using drift fencing and pitfall traps can be undertaken to determine their presence in terrestrial habitats.

If great crested newts are likely to be affected by a proposed development, a European Protected Species licence will be needed prior to the commencement of works. The loss of breeding ponds or terrestrial habitats will require mitigation which can involve installing exclusion-fencing over part or all

of the development site, the trapping and transfer of them to a pre-prepared receptor area, the creation of new ponds and the management of terrestrial habitats.

2.7.7.5 Otter Survey

Otters and their habitats are fully protected under the UK and European law. Developments affecting otters or their resting places will require a European Protected Species Licence prior to the commencement of bank-side works.

Otter surveys are not seasonally constrained and can be undertaken throughout the year, although they can be limited by vegetation cover and poor weather conditions

Survey methods involve the recording of signs such as footprints, spraints, feeding areas, holts and resting areas, as well as an assessment of the suitability of habitat features to support otters.

Mitigation for otters can include locating site compounds away from riverine habitat, restricting lighting in the area near the watercourse at night and excluding construction workers from these areas. If a proposed development is likely to result in the significant loss of habitat, mitigation may involve habitat creation and the construction of artificial otter holts in sections of the watercourse which will remain unaffected by the works. Sympathetic bridge design and the installation of otter-proof fencing along existing or new roads may also be required to ensure that otters are not forced onto any nearby carriageways during times of high water.

2.7.7.6 Red Squirrel Survey

Red squirrels are a protected species (under Schedule 5 and 6 of the Wildlife and Countryside Act 1981). By law, it is illegal to kill, disturb or injure red squirrels, or to damage their dreys, whether this is done deliberately or recklessly. Therefore, when considering a development proposal, the local planning authority and licensing agencies often dictate that surveys are carried out to determine the effects of the development on red squirrels, and to identify if mitigation, compensation or enhancement measures are required.

Red squirrel surveys usually include methods such as visual vantage point surveys, hair tube surveys, drey counts, searches for feeding sigs or using whole maize bait. Sometimes remote camera traps can be deployed. This can provide a good opportunity to record other types of wildlife present around a potential development site, such as badgers, foxes and deer.

2.8 Ecological Clerk of Works

2.8.1 Role

The role of Ecological Clerk of Works (ECoW), as a requirement of the wider construction team, ensures that the construction works are undertaken in accordance with legislation and best practice, project plans and assessments, licence methodology and mitigation, and Client requirements (including constraints and mitigations, discharging, and adhering to conditions of planning).

2.8.2 Duties of the Ecological Clerk of Works

2.8.2.1 Design Stage

- Work with trail designer and contractor during the trail design period to ensure no impact on protected habitat and species as part of the development of the walking trail routes. This will involve walking and agreeing the proposed routes together, planning consultation responses and ground truthing.

2.8.2.2 Specification Stage

- Ensure biodiversity considerations are built into the design documentation – with consideration for access to site/ storage of materials/ minimal impact to habitats and species, management of invasive species, demarcating sensitive areas etc.
- Ensure there is no impact on small areas of wetland, along with drainage channels supporting wetland flora and watercourses. Mitigation measures in the Construction Environmental Management Plan (CEMP), as produced by the Contractor, will be followed.
- Assist with discharging conditions of planning.

2.8.2.3 Construction Stage

- Oversee the implementation of the CEMP.
- Produce and deliver induction and toolbox talks to contractors, which will provide a means to explain the ecological sensitivities of the site, proposed works, methodology and risk assessments.
- Undertake pre-construction checks of all areas within 25m of the trail sections in relation to targeted protected habitats and species – including ornithology surveys to mitigate risk during bird breeding season. If protected wildlife is found works are to be halted and further advice sought on appropriate mitigation.
- Ensure that all trees are checked for roosting bats by the ECoW, within twenty four hours prior to any works within 5m, and bat absence confirmed before any works take place.
- Work with the contractor to implement and maintain exclusion zones around breeding birds, badger sett and the trail corridor with fencing and or tape.

- Attend all progress meetings alongside contractor and client team – including provision of an ecological update.
- Provide fortnightly written updates (at least A4 page) to client team– these may be through or separate to progress meetings and records of the update and content must be retained.
- Undertake regular checks regarding works' progress and feedback to contractor, project team and Client.
- Ensure a paper trail of all monitoring visits is maintained throughout the construction period.
- Assist with discharging conditions.
- Complete relevant documentation on an ongoing basis.
- Provide short site visit reports.
- Input into meetings.
- Work with the project team to provide solutions to any issues that arise during the works.
- Direct construction workers in discharging mitigation and enhancement measures.
- Implement and maintain exclusion zones.
- Where required, directly engage with the public during the works, and with regulators e.g., to put implement licensing etc.
- Provide details of any temporary lighting to be used to minimize impacts on foraging bats.
- Oversee the construction of any mitigation features that are required as part of the project. This can include habitat restoration / construction, the installation of specific structures for species mitigation, and construction of enhancements for example, ponds and hibernacula.

2.8.3 Ecological Clerk of Works – Required Skills and Experience

- Qualified, chartered and experienced ecologist - IEEM or LI Associate.
- Minimum 1 year of relevant ECoW experience.
- Sound ecological knowledge of relevant habitats and species to the project.
- Good knowledge of, and experience in, applying RoI nature conservation legislation and best practice.
- Experience in carrying out ornithology surveys.
- Good communication skills.
- Ability to produce and deliver concise and relevant toolbox talks to contractors.
- Possess an understanding of the engineering / construction requirements and methodology of a scheme.
- Confident and experienced in directing contractors in their operations when required.

- Flexible and has the ability to adapt to changes in ways of working; modifying method and approach accordingly.
- Displays practical approach and the ability to identify solutions and provide advice when necessary.

2.9 Project Development – Project Management and Contracting of Construction Works

This section considers project management of development works and construction contract types suitable for trail works on the BBW.

2.9.1 Consultant Project Management Team

For construction works where goods/ services must be tendered for, it is recommended by Central Procurement Directorate (CPD) that a suitably qualified and experienced Consultant Project Management (CPM) team oversees the tendering process.

Below is an example of the role of the CPM Team:

Full project management of a Design and Build Contract including Construction Design and Management Co-ordinator

This includes-
- Advice on the type of contract.
- Preparation of all necessary contract documentation / drawings for tender process.
- Management of all contracts including tender assessment and advice on appointment.
- Supervision and sign-off of the construction works.

In addition, the CPM Team should advise on:

- The type of Contract, e.g. Design or Design and Build.

- The form of Contract, e.g. NEC Short Form Contract or other.

- The procurement procedure e.g. 1 or 2 stage process. One stage process - Invitation to Tender (ITT) only, 2 stage process - Pre-Qualification Questionnaire (PQQ) followed by an ITT.

2.9.2 Construction Contract Types

2.9.2.1 Design and Build – all sections excluding 'Remote/Upland'

It will be the responsibility of the appointed CPM to prepare all documentation and to Tender for the appointment of a suitably experienced Contractor(s) to construct the trail on the ground. It is recommended that aside from areas identified as 'remote/upland' all trail works along the BBW are delivered through Design and Build Contracts. This type of contract necessitates that a suitably experienced designer is included within the Contract Team. It should also specify the requirement for an ECoW on the construction team to work alongside the trail designer and construction team through design to sign off.

2.9.2.2 'Remote / Upland' Sections

Sections of the Beara Way, Sli Gaeltacht Mhuscrai and the Ballyhoura Way were identified through trail audits as requiring a specialist approach. Consultation was undertaken with upland trail specialist Chris York ('Walk the Talk') to ascertain best practice approach for these areas in respect of future works. Sections of the route that are remote from settlements or public roads could be defined as "remote rural" rather than upland. Upland areas might typically include land over 350m altitude, but there are low lying areas, for example sections of Beara Way, that are challenging terrain. A path could be constructed as 'upland style' in these areas based on a strategic approach to development so that there are no sudden changes in construction style in, or near to, settlements or roads / tracks.

Characteristics of these areas include any combination of: steep gradients, rough terrain, exposed bedrock, deep peat, more than a kilometre to vehicle access, sensitive habitats etc.

Further detail on recommendations for build types within these areas follows in Section 6.11. Recommendations relevant to specific sections is detailed in Section **Error! Reference source not found.**. It is recommended that these sections are treated separately to the remainder of the BBW and that future works within these identified areas are undertaken through two contracts:

- **Specialist Trail Design:** additional detailed design works should be undertaken by an upland trail specialist to inform best practice recommendations. This should be contracted separately; Design should be undertaken in line with the standards for Upland Path Management (as published by UPAG), giving rise a specification survey with bill of quantities. The generic costs of survey are estimated between €800 and €1,200 per kilometre, depending on the complexity of terrain, and assume reasonably continuous sections with good access to site. Design of

multiple short sections with poor access and geographically spread would be likely to have a higher overall cost.

- **Build Contract** based on bill of qualities / detailed design specification.

Additional recommendations for developing identified 'Remote rural/Upland' sections are outlined in section 2.10 below.

2.10 Path Development Principles in 'Remote rural/ Upland' Sections

Two radically different approaches to further developing the path infrastructure in remote rural and upland areas could be used:

- Proactive development – where the whole route is implemented through a planned programme of capital and revenue funding (construction and maintenance).
- Responsive management – where the route development evolves in response to predefined scenarios and ground conditions.

Irrespective of the selected approach, development of the route in remote rural areas should follow the Helping the Hills Principles[1] (notwithstanding that this is a development orientated project rather than conservation focussed) with a premise of low visual impact and high-quality construction. The quality of the path affects the visitor experience so cannot be separated from the aim of a 'world class trail'.

A detailed analysis of deep peat is probably the single most important issue to resolve, particularly where this coincides with steeper gradients. The cost and complexity of path development is significantly impacted by deep peat and if there are designated habitats (i.e. under the Habitats Directive) there may be regulatory constraints that make development more challenging or impossible – it would be difficult to argue any overriding social or economic issues give licence to impact these areas. Ad hoc development of short (easy) sections may lead to extreme difficulty bridging gaps at a later date, so it is recommended to identify areas of greatest physical constraint before continuing investment with this project. Additional recommendations for this specific approach to trail

[1] http://www.helpingthehills.ie/

development and construction in 'Remote rural/Upland' sections can be found in Section A, Construction Standards, Section 6.11.

2.10.1.1 Proactive development

Proactive development would involve the strategic planning and programming of path development across the whole route to agreed minimum standards, which would provide a consistent visitor experience. This does not translate to a single 'style' of construction, more it would provide the criteria for construction and management that can be implemented locally. It would be important to identify and monitor areas of greatest vulnerability / highest potential for rapid deterioration (e.g. areas of deep peat, steep gradients, poor drainage of surface water) rather than focus solely on delivery of 'quick wins' or harvesting 'low hanging fruit' as this may lead to foreseeable environmental damage in more sensitive areas as a result of higher levels of use. Planning should also identify coherent sections of path, bounded by robust end points (e.g. a vehicle track or road). Spot repairs / patching and ad hoc development have the potential to exacerbate any problems of erosion if they do not take account of surrounding ground conditions. For example, trampling pressure at the end points of work on soft ground (e.g. end of bog-bridges) tends to mean that the investment fails.

This could lead to 'excessive' development of remote sections of path where footfall is extremely low and nominal cost per user is very high. However, lack of planning for predicted environmental response to use would be highly irresponsible.

2.10.1.2 Responsive development

If a reasonable monitoring system can be put in place, a responsive development regime would see path infrastructure constructed only when it is necessary, in response to physical changes on the ground. Standards for development would be the same as for Proactive Development but the point of implementation would differ. This approach is based on rational and planned responses to change rather than reactive management.

An assessment of potential impact on the habitats for various scenarios of use should be made. This should include seasonal differences in use as well as overall numbers as this can affect the ability of natural surfaces to recover from trampling pressure. This assessment needs to take account of the likely responses of vegetation and underlying substrate to expected levels of use and provide a clear rationale for development proposals at different stages. For example, it may be reasonable to define 'acceptable limits of change' as a means of determining an intervention point rather than constructing the entire route. Sensitive habitats may have extremely low 'carrying capacity' or be susceptible to rapid non-linear deterioration, so this assessment is essential, as well as complex.

There are significant risks associated with this approach – realistic solutions must be identified for the whole route prior to embarking on this option, along with the guarantee of funding to intervene at the appropriate time and maintain the investment. There are associated risks for budget management as it is difficult to predict medium term financial requirements, which could make securing external funds for such uncertainties more precarious. However, without precautionary measures in place, route development of this type would be reckless.

2.11 Trail Build – Workforce Constraints and Opportunities

Section 2.4 references development considerations including 'limited contractor and skilled workforce capacity', and Section **Error! Reference source not found.** examines this in further detail specific to trail build requirement in remote rural and upland sections.

Ireland does not have a ready supply of skilled path workers or operators of machinery in the context of trail build. There are limited contractors with experience of complex, high quality path construction and few people with the skills and experience to design or oversee the implementation of a large-scale project of this nature. It would be unrealistic to expect contractors from other sectors (e.g. landscape gardening or civil engineering / building trades) to be able or willing to take on geographically diverse and remote projects in a short delivery period. There would be a need for significant upskilling of a workforce in terms of understanding the need for quality outputs and sympathetic construction techniques.

This means that rapid delivery of the infrastructure is not a reasonable expectation. Specific capacity building for locally based individuals or businesses would be highly recommended.

Opportunities do exist that may provide solutions to this issue through increasing both volunteer capacity and re-skilling of paid workforce. It is recommended that these opportunities are explored in greater detail as part of wider discussions around future trail development. Opportunities include, but are not limited to:-

2.11.1 Bord na Móna Upskilling and Talent Development

Bord na Móna (BnM) is a diverse and complex company facing fundamental change as it prepares to exit the business of peat extraction for energy production by 2030. Its Board is tasked with ensuring that BnM contributes to regional economic development and provides sustainable, quality employment in the Midlands of Ireland. As BnM exits the peat business, the challenge for the Board is to ensure the continued viability of the traditional businesses for as long as possible while continuing to grow the

renewable power generation and resource recovery businesses. It is also important for them to identify new ways in which BnM can continue to fulfil its mandate in respect of the Midlands by leveraging its key assets including its people. An identified objective is to identify and plan ways to do more in preparing their workforce through upskilling and talent development.

Through discussion with Department of Rural and Community Development, an opportunity exists to explore the potential for BnM to redeploy workforce for trail development on its land, and contracted out in wider areas, through upskilling in trail construction and ongoing maintenance.

2.11.2 BBW Specialist Trail Build Training Programme

An opportunity exists to fund and develop a training programme for provision of specialist trail build workforce, in skills including upland trail build. The case study of training currently taking place on Croagh Patrick demonstrates best practice in this field.

The Croagh Patrick Sustainable Access and Habitat Restoration Project is an initiative of the Croagh Patrick Stakeholders Group, funded by the Department of Rural and Community Development and Mayo County Council. As part of the sustainable access and habitat restoration project on the pilgrim path on Croagh Patrick, a team of four trainees are working on the mountain, led by experienced Scottish upland path builder Matt McConway. The team includes Frank McMahon a founding member of Mountain Meitheal South East and a member of the Limerick Climbing Club. Two of the other team members are graduates of the Outdoor Education course at GMIT Mayo.

The pilgrim path on Croagh Patrick has been acknowledged as the most eroded mountain route on the island of Ireland and its repair has presented opportunities to share learnings with those involved in managing other upland paths.

The Croagh Patrick Stakeholders Group is confident that they have a team in place with the capacity and commitment to deliver an exemplar access solution for Croagh Patrick, while developing the skills, structures and arrangements required to maintain and manage the mountain sustainably into the future.

2.11.3 Volunteering Opportunities

“Meitheal” is the Irish word for a workgroup usually made up of volunteers who come together to work on a project for the common good or to benefit the community. Mountain Meitheal Ireland is the governing body for Mountain Meitheal branches who undertake projects to protect and conserve mountain and forest areas in Ireland. They maintain trails which are sympathetic to the surrounding countryside and promote sustainable recreation by encouraging personal responsibility and awareness.

Mountain Meitheal was founded in 2002 and offers the opportunity to give something back by volunteering to work on trails thereby protecting Ireland's fragile environment. It works in partnership with Coillte, the Dublin Mountain Partnership, National Parks and Wildlife Service, the Wicklow Way Partnership and also with private landowners.

Subject to further discussion on future trail management and governance of the BBW, as referenced in section 2.6, an opportunity exists to engage with Mountain Meitheal to explore volunteer support specific to remote, rural and upland sections of the BBW.

2.11.4 Green Procurement

In addition to the commitment to maximise use of recycled materials in trail construction green procurement practices will be adopted in implementing the Trail Plan at project level. This will aim to source goods, services or works that have a demonstrable, reduced environmental impact.

SECTION A - CONSTRUCTION STANDARDS

3 CONSTRUCTION STANDARDS FOR THE BEARA BREIFNE WAY

The section aims to provide information that, if adhered to, will ensure consistent, quality and sustainable trail development for the BBW, and its component trail sections. This information specifically relates to the development of sustainable, non bitmac, off-road trail sections along the route.

Trail construction techniques proposed within this section combine 20+ years of Outdoor Recreation Northern Ireland (ORNI) in-house trail development experience with relevant, best practice guidance from other industry leaders including:

- Sport Ireland Outdoors Walking Trails Criteria for Ireland (2020).
- Helping the Hills Principles to guide the management of path erosion in Ireland's upland areas (2014).
- Outdoor Access Design Guide - Paths for All / Scottish Natural Heritage (2016).
- Upland Pathwork Construction Standards for Scotland - Paths for All / Scottish Natural Heritage (2015).
- Lowland Path Construction Guide for Scotland – Paths for All / Scottish Natural Heritage (2019).
- Managing Visitor Safety in the Countryside (Principles and Practice) - Visitor Safety Group (VSG).
- 'Principles and Standards for Trail Development in Northern Ireland' (ORNI, 2013).

Trails developed by ORNI adhere to the sustainable trail principles contained within the documents referenced above.

3.1 Who this section is for?

This section should be used as reference by all contractors procured for design and build contracts for trail build works on the BBW. The contents will also be of use to key trail section contacts, local authorities and community groups along the trail, to ensure future development is undertaken in a consistent manner and to a high-quality specification.

3.2 Background

An assessment of the current condition of trail along the length of the BBW was carried out through a combination of desk-based research, consultation, and physical trail audits. A full audit methodology and detail of data collected is provided in Section 8.1.

Trail audits undertaken identified works deemed required on the BBW to enhance the trail to 'international standard'.

This section provides an overview of all trail construction techniques, trail furniture and infrastructure that has been proposed. Whilst the information contained within this section provides the theory and general specification required, the breakdown of section-by-section works required is contained within Section C – Technical Supplement and Costs.

In addition to the trail audit completed as part of this project, and as previously referenced in Section 2.9.2, sections of the Beara Way, Sli Gaeltacht Mhuscrai and the Ballyhoura Way require a specialist approach. Consultation was undertaken with Upland Trail specialist Chris York ('Walk the Talk') to ascertain best practice approaches for these areas in respect of future works.

4 TRAIL TYPES AND CATEGORIES

4.1 What is a Sustainable Trail?

Trails provide a diverse range of people with a variety of ways to access the outdoors for recreation. They can add huge value to places and landscapes, but equally if they are not designed and built properly or are not in the right place, they can devalue places and landscapes and become difficult and or expensive to manage and maintain. Therefore, correct trail design from the outset is essential when planning sustainable trails. Figure 1 shows how a designed and built trail can sit seamlessly within the landscape.

Sustainability as defined here, is considered in its widest sense and includes consideration of 5 key components. A sustainable trail must not have an unacceptable impact on the:

1. Land use (and vice versa i.e. land use must not have an unacceptable impact on the trail)
2. Landscape
3. Habitats
4. People and communities (including those who currently use the space where the trail is proposed)

In addition, a sustainable trail should not require an unacceptable level of -

5. Management and maintenance

Figure 1 Sustainable trail sitting seamlessly within the landscape

4.2 Trail Types

Trails are defined by usage type as:

- Multi-use - a trail that is not focused on a single recreational activity. A multi-use trail may therefore cater for several different activities such as walking, cycling or horse riding.
- Single-use - a trail that is dedicated to a single user group such as walkers, cyclists or equestrians.

This project focuses on the BBW single-use walking trail. It should be noted that a Beara Bridle Way is currently in development with some sections already operational on the Beara Peninsula. The Beara Bridle Way was not audited as part of this project and recommendations contained within this report do not relate to bridleway sections. Additionally, small sections of the BBW offer multi-use trail with capacity to accommodate cyclists. These sections are primarily found close to urban settlements or where the trail shares the route with an existing multi-use trail section. Longer-term development of the BBW may see the creation of additional multi-use trail sections, e.g. where the route is shared with cycleways in development such as sections of the preferred corridor for the Athlone-Galway cycleway. Recommendations contained within this report focus purely on shorter-term development of a single-use walking trail. Where the route of the trail stays the same, all existing users will be facilitated by any recommendations put forward.

Trails can further be defined by Category. The key attributes that define Trail Category are as follows:-

- Trail width

- Trail gradient
- Trail surface
- Line of sight
- Trail features

4.3 Trail Categories Summary Table

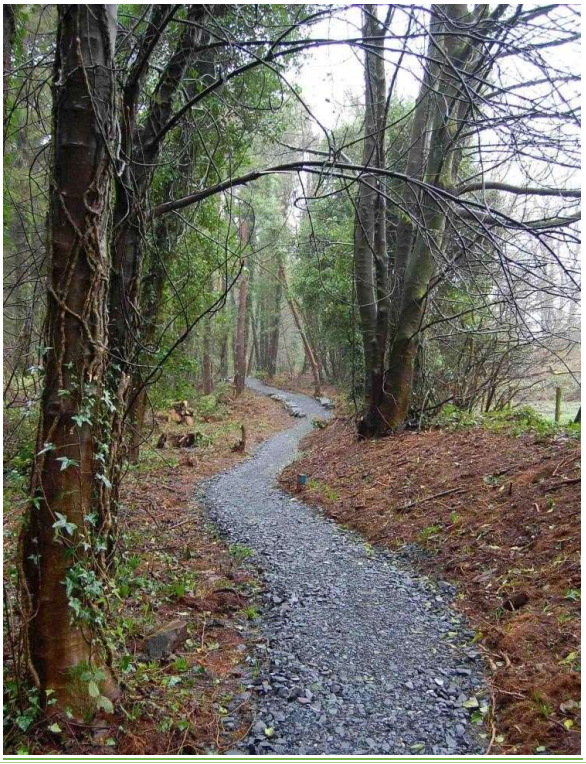
Key trail attributes	Category 2 Multi-Use Trail
Description	These are trails that are accessible to a wide range of users and abilities but NOT ALL users due to issues relating to trail gradients, trail surfaces and trail features. Users include: • Pedestrians of mixed abilities including young children and some baby buggies • Cyclists of all abilities other than very young children or bikes with stabilizers or wheels less than 400mm • Equestrian users of all abilities • Category Two Multi Use Trails are not suitable for those of limited mobility or with impaired vision
Width	Optimal width 1.8m
Surface	Consistent sealed surfaces and can include asphalt and compacted stone or gravel
Gradients	Maximum average gradient - not more than 5% Maximum absolute gradient - not more than 10% for more than 50m
Lines of Sight	Minimum 30m
Trail Features	Small level changes of not more than 60mm deep and not less than 300mm width. Grade reversals of not less than 10m in length and not more than 1m depth. Bridges must be not less than 2m wide and must have handrails throughout Category Two Multi Use Trails should not include steps.
Suitable for	All users

The photograph below shows a Category 2 Multi-Use Trail. Note the wide flat trail with good lines of site. This trail has been designed to cater for walkers and horse riders.

Key trail attributes	Category 3 Single Use Trail
Description	These are trails that are less accessible than both Category 1 and Category 2 multi-use trails and are therefore more suited to specific users and activities. These trail sections will be suitable for pedestrians – walkers and runners of mixed but NOT ALL abilities.

	Some sections of Category 3 trail on the BBW may be suitable for off-road cycling. Some sections of Category 3 trail on the BBW may be suitable for equestrians if established and classified as Beara Breifne Bridle Way. Category Three trails on the BBW are not suitable for the following users: • Those of limited mobility or impaired vision • Those with a standard child's pushchair • Bikes with wheels less than 50mm, tag-alongs, trailers or child carriers
Width	Optimal width - 1.2m - 1.5m
Surface	Variable but stable surfaces, can be slightly uneven and include some loose material. Surfaces may include compacted stone and gravel, soil, grass, sand and mud.
Gradients	Maximum average gradient - not more than 8% Maximum absolute gradient - not more than 15% for more than 300m
Lines of Sight	Minimum 20m
Trail Features	These trails can include level changes such as steps, roots, rocks, potholes, water bars and drains. Level changes must not exceed 150mm height in relation to pedestrian only trails and be not more than 50mm in relation to all other trails including cycling and equestrian trails. Grade reversals not less than 4m in length and not more than 1m depth. Timber boardwalks of not less than 1200mm width and not more than 300mm height above ground level. Bridges should be not less than 1200mm width with handrails throughout.
Suitable for	All users

Examples of Category 3 trails may be found in country and forest parks but are less likely to be found in urban or semi-urban settings. The photo below is an example of a purpose-built Category 3 multi-use trail. Note the limited clearance between the trees and the relatively flat trail surface.



Key trail attributes	Category 4 Walking Trail
Description	Category 4 Walking Trails have variable gradients and surfaces and may be found in a very wide variety of environments including more remote upland sites. These are trails where access is more restricted by issues such as gradients, trail surfaces and the nature and size of trail features. This means these trails may not be suitable for use by all user groups at the same time. Category 4 trails are suitable for the following users only: • Pedestrians – mixed ability walkers and runners Category Four Multi Use Trails are not suitable for the following users: • Off-road cyclists • Equestrians – leisure and endurance riders • Those with limited mobility or impaired vision • Off road cyclists using bikes other than mountain bikes - not tag-alongs, trailers, child seats and stabilizers • Those with baby buggies • Novice equestrians
Width	Optimal width - Minimum 600mm wide | Maximum 1.2m wide
Surface	Very variable and uneven including loose material, rocks, mud, gravel, soil, roots, grass and other vegetation. Surfaces may change suddenly and vary over short distances
Gradients	Maximum absolute gradient - not more than 20% for more than 300m
Lines of Sight	Minimum 15m
Trail Features	These trails can feature unexpected and sudden level changes caused by steps, roots, rocks, ditches, drains and water bars of not more than 300mm in relation to pedestrian only trails. Trails should include obstructions to prevent use by other trail users as shown in photographs below. Turns of up to 180 degrees. Grade reversals of not less than 2.5m length and not more than 1.5m depth. Boardwalks not less than 600mm wide and not more than 1500mm high above ground level. Bridges should be not less than 1m wide and should have handrails throughout if more than 1500mm high above ground level. May feature encroaching vegetation and have limited clearance in relation to trees etc.
Suitable for	Walkers only
The photographs below show examples of purpose-built Category 4 Walking Trails. Note the narrow trail and the level changes as well as the uneven surfaces and obstacles.	

4.3.1 Summary of Trail Categories on the BBW

As outlined above, generally, Category 2 trails are 'Multi Use' and Category 3 or above trails are 'Single Use'. The majority of the BBW is classified as **single-use trails of Category 3 or Category 4**.

Small sections of multi-use Category 2 trail are found primarily within urban areas, for example in urban parks.

Recommendations for upgrade and new build works on the BBW are detailed in Section **Error! Reference source not found.**. The majority of these recommendations are for Category 3 and Category 4 trails, with a recommended average trail width of 1200mm. This approach will ensure construction is sensitive to the surrounding landscape.

Sections where heavier footfall is anticipated may require Category 2 trails where ground conditions and topography allow.

It will be the responsibility of the contractor to assess trail category required for each section as part of pre-construction detailed design period. This assessment should be made further to site visits undertaken to assess current ground condition and any constraints.

4.4 Trail Surface types

Path surfaces fall into five main types: natural, unbound, semi-bound, bound and porous. The BBW currently comprises the following trail surface types:

4.4.1 Natural surfaces

In some sections of the BBW the path does not require a formally built surface. The existing vegetation and ground condition has been deemed appropriate for the expected users and setting, especially in remote, rural areas (Figure 2). Regular grass mowing will help to define the path and improve the strength and wearing quality of the grass. The addition of drainage works may have been identified to further improve the surface by removing muddy areas and puddles as required. With high volumes of use, natural surfaces will be susceptible to rapid wear and tear which requires careful maintenance and management to prevent deterioration beyond comfortable use. In these areas unbound built trail has been identified as preferential.

Figure 2 Existing sections of trail on the BBW where no works are required

4.4.1.1 Unbound surfaces

An unbound surface is generally made of well graded aggregate. It relies on the friction between the different sized stone particles to bind them together for strength and durability. Generally, the aggregate is very fine and particle sizes range from 4mm, 5mm or 6mm to dust. Common unbound surface types are whin dust, limestone and granite dust, depending on the local geology. Coarser aggregates can be used to provide more surface texture. Because stone particles are not bound together, these surfaces are susceptible to being washed out by water, so careful surface drainage is required. New unbound surfaces tend to be soft until fully consolidated - usually after a fall of rain and some pedestrian use. Large sections of both existing trail and recommended trail build on the BBW utilises unbound aggregate surface, see Figure 3 and Figure 4 for examples.

Figure 3 Existing sections of unbound gravel trail - no works required

Figure 4 Existing section of unbound hardcore vehicular access trail - no works required

4.4.1.2 Bound surfaces

A bound surface is a combined layer of well graded aggregate glued together by a binder, such as bitumen. This top layer is called the 'surface course', a term used in road and pavement construction. The building of bound surface trail is not recommended for future development of the BBW. As outlined in the detail trail audit, the route does incorporate sections on existing bound surface, see Figure 5 for an example. Long-term development of the trail seeks to re-route additional sections of the trail off-road to avoid long sections on bound surface trail.

Figure 5 Section of bound surface, on road trail - Lung Lough Gara Way

In sections that remain on road appropriate and frequent 'Warning – Walkers' signage is required to ensure walker safety. Trail audits identified locations requiring signage and costs have been included for this requirement.

5 TRAIL CONSTRUCTION

This section outlines the process required for all sections of the BBW identified as requiring trail upgrade or trail new build.

5.1 Trail Corridor and Corridor Clearing

The trail corridor comprises the full dimensions of the trail, including the area on either side of the trail tread and the space overhead (trail ceiling) that need to be cleared of brush and obstacles. See Figure 6 for detail.

Trail ceiling & corridor clearance

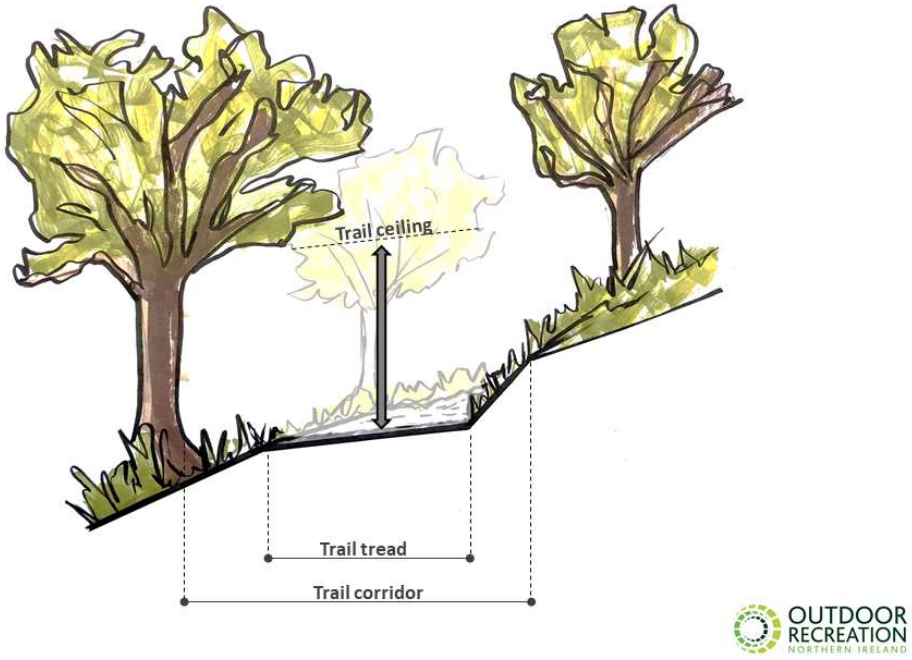


Figure 6 Trail corridor illustration ©ORNI

Corridor clearing is essential to allow access for the construction of the trail and should be carried out sensitively to minimise the impact of the trail on the landscape and habitat. Therefore, the use of hand tools is recommended e.g. chain and handsaws. Only marked (agreed) trees should be felled and any trees within 3 to 4m of the trail should have their branches removed to a height of 2.5m (for walkers and cyclists). This is for health and safety reasons.

It is also essential that:

- Corridor clearing does not destabilise trees e.g. by exposing them to wind blow.
- Consideration is given to the disposal of cut material with particular attention paid to which side of the trail corridor spoil is deposited. This is dependent on the gradient of the side slope.
- All cleared material should be deposited in habitat piles i.e. mounds of not more than 2m height, 3m width and 4m in length.
- Access to the trail corridor is via the proposed trail tread only, and not via multiple access points (dependent upon length, location and current use of the site). This reduces the physical and visual impact on the surrounding habitat and landscape.

5.1.1 Excavating Around Anchor Roots

The removal of organic material from around large roots is essential to ensure the long-term stability of trail structures and to prevent compaction and subsidence. When organic material is excavated from around the anchor roots of standing trees, great care must be taken to ensure significant damage to the tree is avoided and the stability of the tree is maintained. Excessive excavation around roots, the removal of roots, or damage to anchor roots can lead to trees becoming unstable and susceptible to wind-blow and also vulnerable to disease. Great care should therefore be exercised during excavation; this should be done using hand tools, particularly where root systems are shallow or on steep (over 20%) side slopes. When excavating organic material from around anchor roots, small roots (up to 80mm diameter) may be removed with the aim of creating a stable base for building up levels around the remaining roots using suitable imported material. All large voids (more than 150mm x 150mm) should be filled with clean stone or 80mm to dust subbase material. Figure 7 shows excavation and packing of anchor roots by hand.

Figure 7 Excavation of anchor roots by hand and packing of anchor roots by hand

5.2 Trail Construction Layers

Construction methods vary depending on the build type required and the sensitivities of site. Hand built stone path works in upland areas will require a different construction method to installation of boardwalk or bog bridge. All specific build types that have been recommended for development of the BBW are detailed in section 6. As the majority of trail build required has been identified as constructed aggregate path, this section summarises the construction process for such.

A constructed aggregate path comprises different layers that form a surfaced structure capable of sustaining walker footfall. Each layer serves a particular purpose, see Table 1.

Layer	Purpose
Formation Layer	The prepared ground surface on which the path's base layer is laid and compacted
Separation and Reinforcement Layers	Manmade geotextiles used to separate the base layer from the formation layer and to reinforce the base layer on a weak soil
Sub-base / Base layer	The load bearing path foundation, required for deep construction over wet or rough ground Provides strength to the construction and a solid base for the path walking surface
Surface layer	Forms a durable, and firm surface over the path base
Binding	Protects and prevents movement of loose surface material; provides a good walking surface

Table 1 Purpose of constructed trail layers

These layers are explained more in sections 5.2.1 to 5.2.4 below and are visualised in Figure 8.

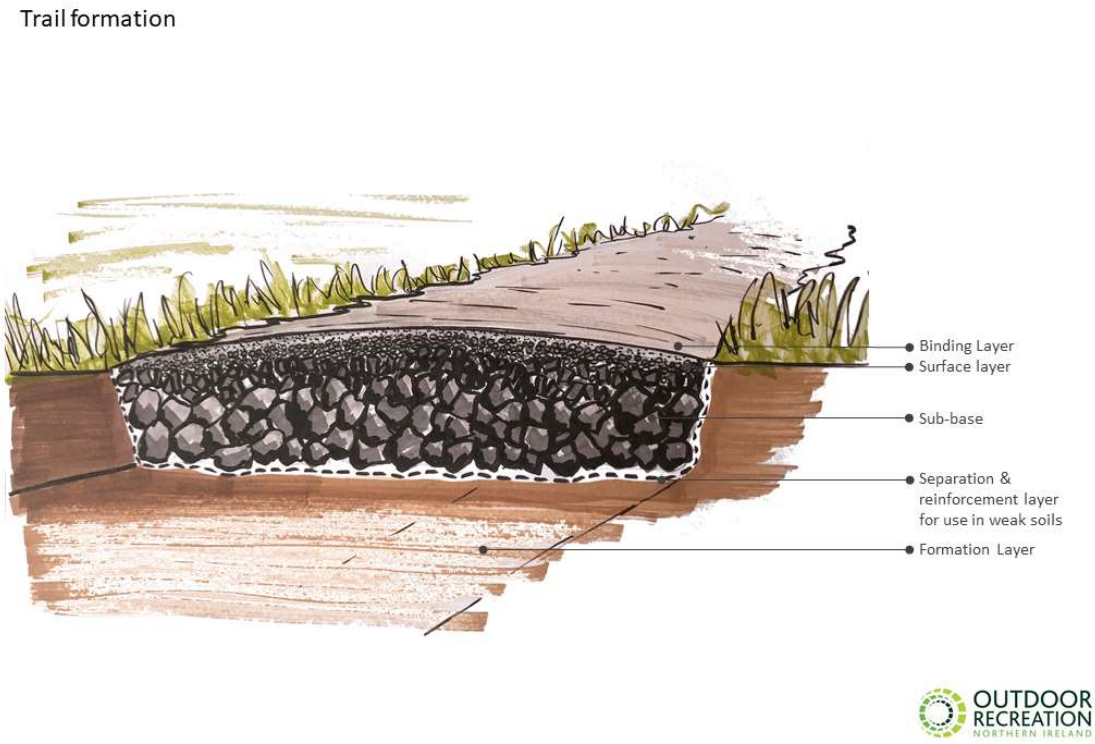


Figure 8 Illustration of trail layer construction ©ORNI

Building a path utilising this layered technique with differing grades of aggregate will significantly increase the path durability, compared to using ungraded 'as dug' material in one, single layer.

These construction layers should be compacted to form a free draining camber trail (refer to Section 6.1.2), or bench cut (refer to Section 6.1.1), for surface water to run off either one or both path sides, depending on the site. Generally a traversing path built into the hillside will have a bench cut, and a path on more open ground will have a camber. Drainage features are incorporated in the path in locations as identified during the trail audits and detailed in Section Error! Reference source not found.. All path edges should be defined, or contained, with turf and boulders.

5.2.1 Formation Layer

The formation layer is the prepared ground on which the path is constructed. Depending on ground conditions and the proposed construction, the work required to produce the formation layer can be anything from just clearing vegetation, through to excavation of organic material to expose suitable mineral soil or substrate. This is necessary to create a stable base as organic layers retain water. This can be carried out by mechanical excavators or hand tools (site dependent). It can be specified that only certain sizes of machinery are used in the trail construction process e.g. 1.5 tonne digger, using

the proposed trail tread, again minimising the physical impact on habitats and landscape while enabling the required trail structure to be created. Please refer to Section 5.5 for further information on machinery suitability for trail environments.

As with corridor clearing, consideration must be given to the disposal of excavated material to ensure that spoil does not result in the restriction of groundwater. Spoil should be deposited thinly and evenly i.e. graded.

Formation Layer Process
• Form the tray by excavating to the width required and the depth required or down to a solid base; infill eroded sections to form a level base. • In areas which are badly eroded use excavated material to infill the gullied width and form the tray base and sides; the tray edges may need to be formed with good size turfs. • Form the tray sides so they are capable of containing the aggregate layers; if the aggregate spreads out, with the pressure of use, the thinner surface will erode and expose the path base. • Incorporate of any drainage requirements identified through trail audits as detailed in Section Error! Reference source not found.. • Depending on type of drainage feature required these may be constructed at any stage of laying the sub-base and base. • Set aside excavated material for path edges or site restoration.

5.2.2 Separation and Reinforcement Layers

Geotextiles and geogrids are man-made ground engineering products made of different grades and strengths of synthetic materials. They are used to separate the base layer from the formation layer and to reinforce the base layer on a weak soil. A geogrid will also protect the formation layer from the movement of machinery when a path's base is built - the continuous movement of heavy machines, transporting materials on to site, over the same ground can cause damage to a soils profile e.g. compaction, wheel rutting. For most light use paths, if the formation layer is well drained and reasonably hard, these synthetic materials will not be required.

For trail development works on the BBW it will be the responsibility of the contractor to establish a requirement for geotextiles or geogrids based on site assessment of ground conditions during the pre-construction detailed design phase. Please refer to Trail Types Recommended for BBW, Section 6.1.3 Raised Causeway / Gravel with Terram.

A geotextile can help to prevent vegetation growth through a path. 'Terram' and similar woven felt-type geotextiles are particularly resistant to vegetation.

Separation and Reinforcement Layers Process
• Geotextiles are rolled out over a prepared formation level in the formation tray, and then stone is tipped on top to build the path's base layer. • The stone is spread out and compacted with the sheet stretching until full compaction is achieved. • The softer the ground, the more stone is required, and more strain is placed on the sheet. It is therefore important to use the right grade and strength of geotextile. • Manufacturers will give information and recommendations on what grade to use. • Only use a geotextile if there is significant clay content in the soil (i.e. the soil is soft and 'sticky' when wet) or if the soil is very weak (i.e. it contains a lot of organic material such as peat). • If the formation is hard or well drained and the sub-soil is granular with little or no clay content, a geotextile will not be required.

5.2.3 Sub-Base and Base Layer

The base layer is the main 'load bearing' layer of the path. It is made up of one or more layers of well graded granular stone comprising a combination of large stones down to fine particles (dust). The larger stones interlock to provide most of the strength. The smaller stones and 'fines' fill in the gaps between the larger stone to help 'bind' the base layer together into a strong solid mass once compacted. The base layer should evenly spread the weight of users from the surface layer above to the formation layer below. A smooth, even and well compacted base layer is essential for a high-quality surface.

The base layer should be thoroughly compacted in layers to maximise its strength and binding properties. Compaction of the base layer removes the air between stone particles and therefore increases the solid mass density of the well graded granular sub-base material. A vibrating roller or whacker plate is used to compact the material.

Sub-Base and Base Layer Process
• Graded stone should be placed into the tray to the depth required for each layer; This requires use of larger graded stone for the bottom layer, and smaller graded stone for the top layer, below the surfacing. • The graded material should be in layers that are no more than twice the depth of the maximum stone size to enable optimal compaction. • Incorporate shaping for the camber or crossfall required in each layer; with the material slightly thicker in the centre of the path to form the camber, or on the uphill side to form the cross-fall. • Compact each layer with a wacker plate or a hand tamper in sensitive sites.

- The level of the top layer should allow for the surfacing and binding layer to be flush with path edge vegetation after some settling of the sub-base. If there is any doubt about the compaction, add more surfacing, as it will settle with use.

5.2.4 Surface Layer

The surface layer is the most important part of the path from the users' point of view. It is the only part of the path with which they will make contact, but it also needs to transfer their weight to the base layer below. The surface layer is therefore critical to both the usability and appearance of the path.

Surface Layer Process

- Lay the surface and finish with binding material.
- Lay and compact the surface material to the depth required over the full path width; this should be at least 50mm, but more may be required depending how well compacted, and interlocking, the base is.
- Allow for some settling and loss of material into the base during compaction, and over time.
- Allow adequate depth at the path edges. If surfacing is too thin the material will protrude and lead to breaking up of the path, with use.
- Spread and carefully compact the binding material over the top of the surface, with the path edge surface flush with the ground level.

5.3 Hand finishing

It is essential that surfacing material is compacted using mechanical means such as rollers or whacker plates and that all surfacing material is blended in to back-slopes or revetments in order to ensure that surface or ground water can 'sheet' across the trail surface.

This involves using hand tools to complete the following:

- Blend back slope.
- Establish appropriate tread profile.
- Demarcate the trail using imported block stone (where required).

5.4 Demarcation

Trail demarcation should be used to define the line of the trail and keep users within a narrow corridor. This will ensure that the user makes use of the most robust part of the trail surface and not impact the surrounding, less robust ground (i.e. trail creep). Demarcation must be effective, obvious and look as natural as possible.

5.5 Machinery Considerations in Trail Environments

As referenced throughout this document, to minimise impact to the site and trail corridor during construction, construction machinery to haul, lay, excavate and compact materials should be kept to a functional minimum.

Machinery should be no wider than the trail corridor and should be suitable for ground conditions and any steep side slopes. For example - moving materials to and from the trail corridor should be completed using a low ground pressure dumper, tracked dumper or dumper. All machinery must be agreed with the client for all sections in a method statement prior to construction and must not negatively impact on the landscape.

Where additional access points (i.e. other than start and finish of each section) are required along a section, these should be agreed with the client. Additional access points should be minimised to avoid unnecessary damage to the landscape.

As recommended in Section 2.9.2, trail works for all sections of the BBW (***excluding*** those identified as requiring specialist approach i.e. 'remote rural upland' areas) should be procured through Design and Build Contracts. It will therefore be the responsibility of the Contractor to employ a qualified trail designer to assess section requirements and provide construction guidance for all works required including specifics for recommended machinery. There are many variables that will determine machine suitability and will impact on trail build cost and duration. An example machinery specification is outlined below:

Plant and Machinery Specification Example – trail build in woodland environment containing forest roads:

- Excavator size should range from 1.5 tonne to 5 tonne within dense wooded areas.
- 8-12 tonne excavator for corridor clearing and efficient stump removal in wider areas.
- 5-8 Tonne excavator with tilting hitch for trail construction.
- 2-6 tonne wheeled dumper for on-site materials distribution, tracked dumper when required.
- 3-5 tonne excavators for finishing and materials loading.
- Wacker plate for materials compaction.

NB. It will be the requirement of the contractor to assess the most suitable type of machinery required for trail build further to site visit assessments. Figure 9 and Error! Reference source not found.10 provide visual examples of machinery used on various sites for trail build of a similar scale and nature.

Figure 9 Machinery Types - 1.5 tonne and 5.5 tonne machinery

Figure 10 Machinery types - 3 tonne wheeled dumper and 11 tonne dumper

5.6 Summary Construction Technique Notes

- Trail surface and subbase must be compacted, consistent and stable throughout. May include compacted crushed stone. No loose material.
- For construction purposes, trail to be accessed along trail tread only.
- Making up of levels required to achieve specified trail gradients - levels should only be made up with suitable imported fill. All imported materials to be used along the trail tread only.
- All spoil to be managed with consideration for backslope, proximity to trail tread and landscaping.
- Hand finishing required around roots.
- Blending of backslope.
- Demarcation and landscaping throughout.
- Borrow pits must not be used.

6 TRAIL TYPES RECOMMENDED FOR THE BBW

The previous section has provided a generic overview of the trail build process. This section provides detailed specifications for works required on the BBW.

Trail audits undertaken have informed recommended works required to increase the current quality of the trail. Works include:

- Trail construction – new build trail, trail upgrade (where an existing trail or sub-base exists, but works are required to bring the trail up to a sustainable standard), and minor works (such as installation of water bars for drainage or vegetation maintenance).
- Waymarking and interpretation – costings are estimated based on metal BBW finger post signage, recycled plastic posts and disks, plus interpretation panels similar to those in-situ on the trail.
- Other infrastructure e.g. stiles, gates, bridges, fencing etc.

Table *2* summarises all trail build types recommended for the BBW. The construction standards outlined in this section relate to works itemized by location and ID number in Section C - Technical Supplement and Costs.

Works Identified	Recommended Build Type
Gravel trail (new build)	**It will be the responsibility of the Contractor to assess the most suitable trail sub-type from those outlined below during the pre-construction detailed design period.** This should be assessed through site visits to evaluate ground conditions and any construction constraints. *Please refer to sections:* 6.1.1 Gravel Aggregate Path - Bench Cut 6.1.2 Gravel Aggregate Path - Raised Camber
Gravel trail plus Geotextile	Raised 'floating' trail sections suitable for wet areas: *Please refer to section:* 6.1.3 Raised Causeway / Gravel with Geotextile/Terram
Gravel trail (upgrade)	Areas identified as requiring upgrade comprise established gravel trail with existing sub-base/bedrock. Works required: • Scraping of existing gravel surface to create level subbase and remove obstacles (roots, cobbles, boulders etc.). • Localised vegetation and soil clearance.

	• Machinery to be kept to a functional minimum and to be no wider than trail tread width and to be suitable for ground conditions and slope. • Drainage and topside ditching as required to improve drainage. • Demarcation as required.
Hardcore (new build)	Provision of hardcore surface for vehicular access for farm vehicles only *Please refer to section:* 6.2 Hardcore
Hardcore (upgrade)	As above, upgrade meaning there is already some form of sub-base present and a fresh top layer is required.
Bog bridge	Installation of bog bridge. *Please refer to section:* 6.3 Bog bridge
Boardwalk	Installation of boardwalk. *Please refer to section:* 6.4. Boardwalk
Stone stepping	A mixture of gravel trail with 'stepped' sections to allow for gradient increases, or sections that are wet underfoot. Assumption 50% gravel trail/ 50% stone slabs. *Please refer to section:* 6.5 Stone stepping
Stone pitching	Traditional stone pitching used for steep ascents primarily in upland areas *Please refer to section:* 6.6 Stone pitching

Table 2 Summary Table of Recommended Works

6.1 Gravel/Aggregate Path

Most new build sections recommended for the BBW comprise aggregate path in one form or another. This provides a hard wearing, durable surface capable of withstanding high walker footfall. It should be comfortable to use so that people will keep to it and not use the surrounding vegetation or take alternative routes. Hand finishing and demarcation will help to control this. The path should be free draining, with drainage features incorporated as and where required so that the path can withstand the expected weather and water flow. Figure 11 (left) shows a section of trail with no built surface where the surface is not robust enough to withstand disturbance, in this scenario a built trail is

recommended. Figure 11 (right) shows an existing section of trail which is fit for purpose and where no additional trail works are required.

Figure 11 Trail requiring new build gravel trail, section of existing fit for purpose trail

The aggregate path comprises layers, or grades, of angular, interlocking stone laid in a path tray as previously detailed in Section 5.1.1 Trail Construction Layers.

It will be the responsibility of the contractor to assess specific build types required further to site visits from those detailed below:

6.1.1 Gravel Aggregate Path - Bench cut

This is the most basic of all types of trail construction and involves cutting the trail into the side slope to create a sloped backslope and an outsloped trail tread. In most cases, this involves importing stone to construct the base layer and trail surface.

Full bench cut trails are outsloped at 5% to enable water to travel across the trail and down slope, without causing disruption to the natural flow of the water, or any erosional processes on the trail. The total width of the trail tread is excavated out of the slope and the rest of the trail tread is made up of fill material. See Figure 12 for detail.

Partial bench cut trails are where part of the width of the trail tread is excavated out of the slope and the rest of the trail tread is made up of fill material. See Figure 13.

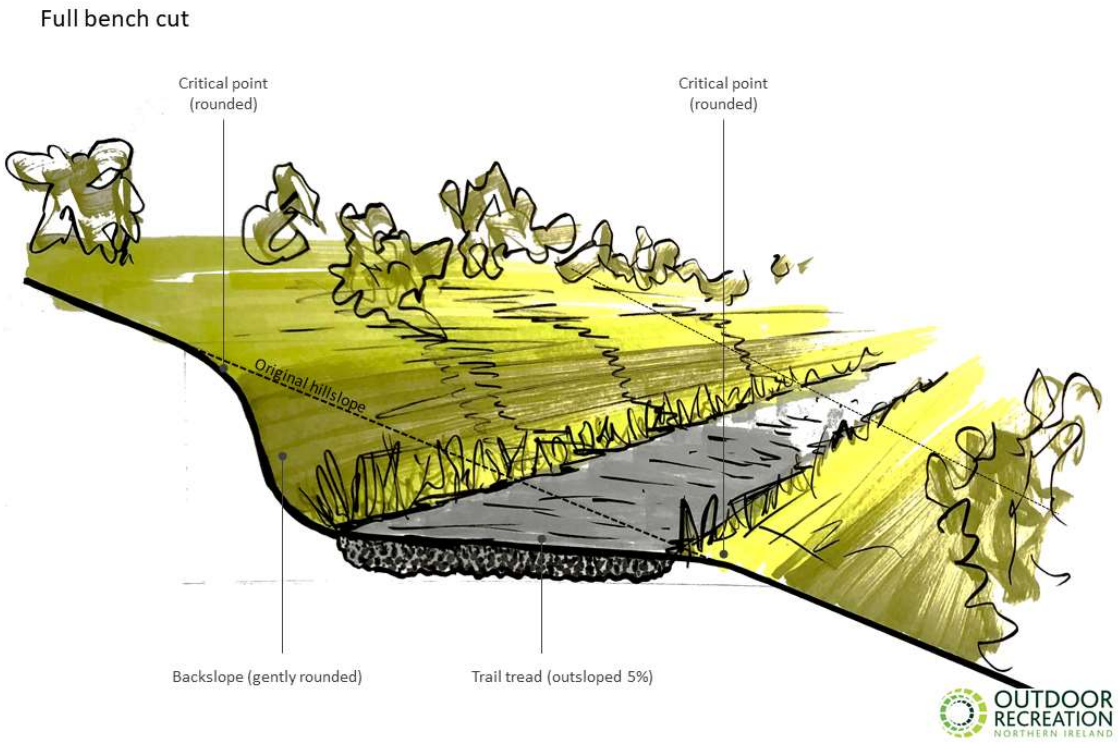


Figure 12 Full bench cut trail ©ORNI

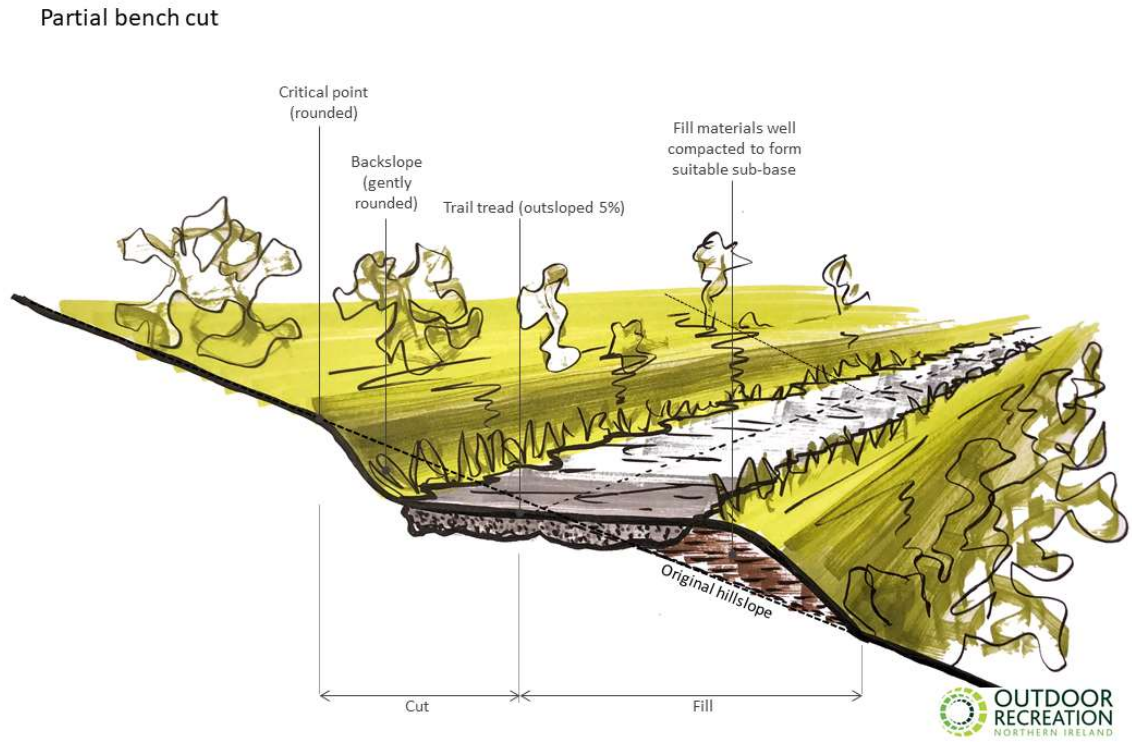


Figure 13 Partial bench cut trail ©ORNI

6.1.2 Gravel Aggregate Path - Raised camber

This is where the trail tread is raised above the surrounding organic material by building a trail structure from suitable imported material. It has either a pronounced crown or is outsloped to one site. Raised camber construction consists of the following key steps:

- Removal of organic layer to expose mineral soil.
- Compaction of mineral subbase.
- Application of subbase material (This may include the installation of a permeable, robust membrane e.g. geotextile or terram with imported stone then used to create the subbase and surfacing.
- Application of surface materials.

This is particularly suitable for ground where the organic layer exceeds 1000mm in depth or on flat ground where a bench cut cannot be obtained. See Figure 14.

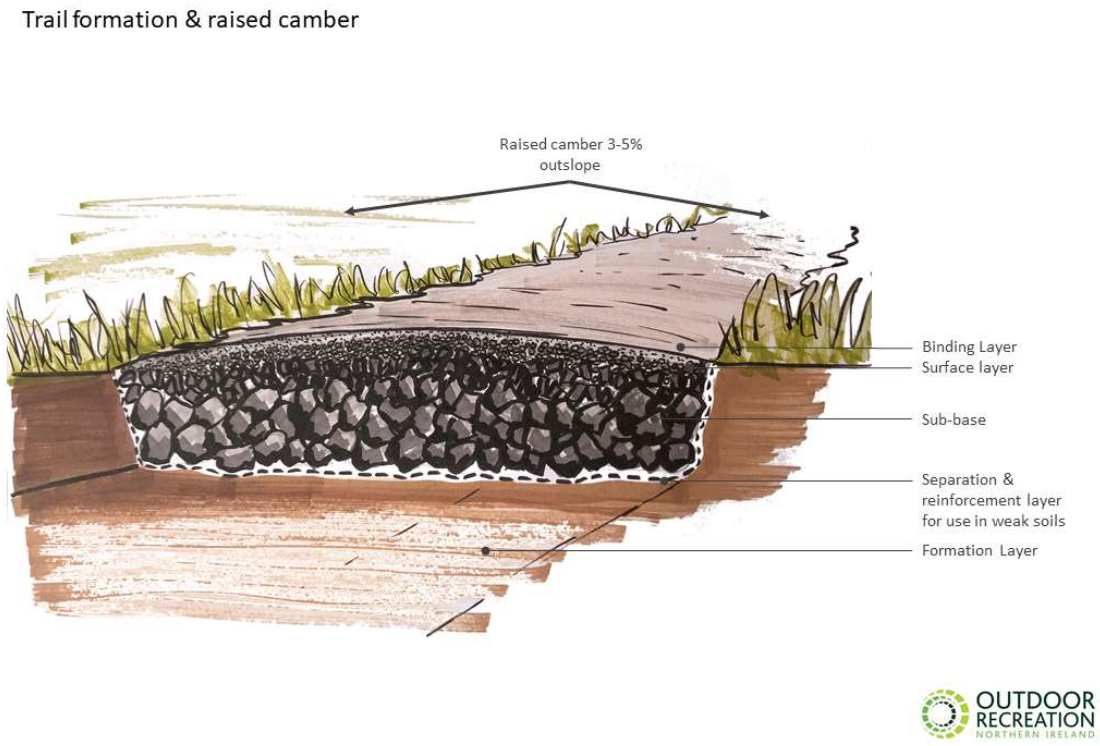


Figure 14 Raised camber trail illustration ©ORNI

6.1.3 Raised Causeway / Gravel with Geotextile

Where a site has a high-water table, is liable to flooding or an excess of organic material, a suitable alternative to a raised camber trail is a raised causeway trail (Figure 15). A raised causeway trail raises

the walking surface where it is not possible to excavate large amounts of surface material. The raised surface also minimises water lying on the route which will eventually lead to erosion and an unsustainable trail.

Geotextile and terram are generic terms used to describe materials used to form a permeable robust membrane. The membrane is used to prevent organic material mixing with the clean stone used to build the trail. Geotextile is normally used through areas of wet ground e.g. over peat, where the organic layer is too deep to remove.

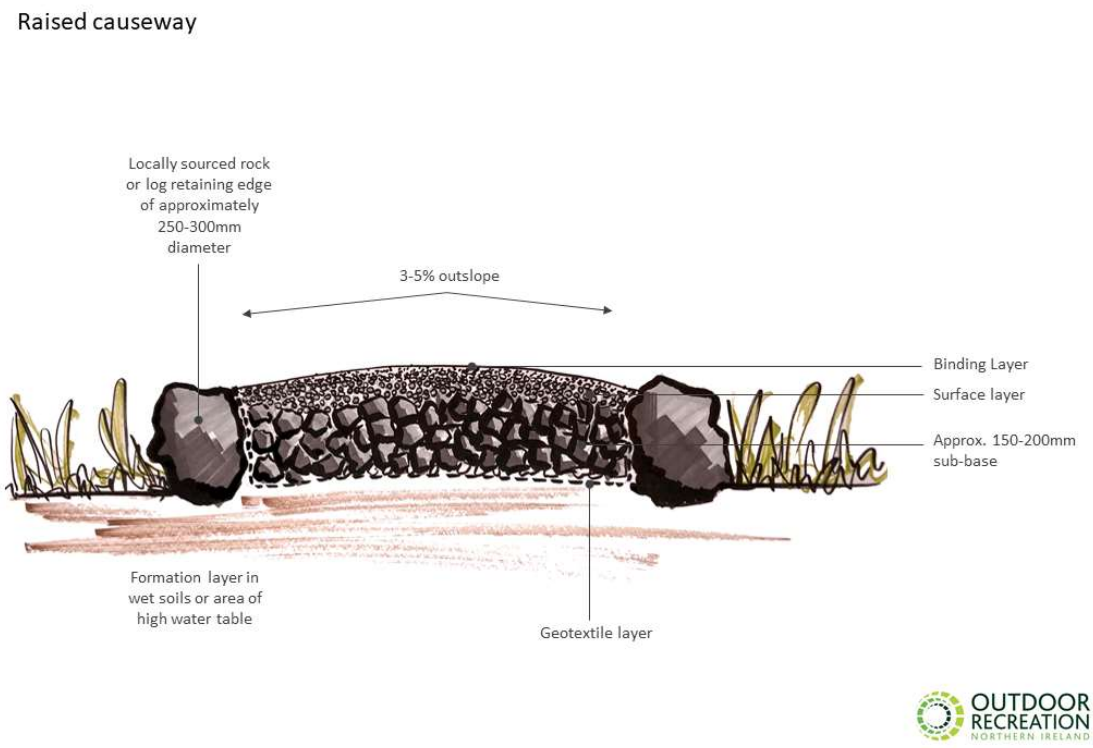


Figure 15 Raised causeway trail ©ORNI

Retaining edges are constructed and a geotextile / terram layer is laid between the edges, this stops the next layer of gravel sinking into the wet soil below. The depth of the gravel should be approximately 150-200mm or greater if a greater variance in height is required. The trail should be finished with a layer of crushed stone and dust and compacted well. There should be a slight crown on the surface to ensure water runs off both sides. Figure 16 shows a section of existing trail where geotextile has not been used and the trail is sinking as a result. Figure 17 shows two sections of trail where new build with geotextile is required in order to address the wet conditions underfoot.

Figure 16 Existing gravel trail with no geotextile resulting in trail sinkage

Figure 17 Sections requiring new build trail with geotextile

6.1.4 Gravel Aggregate Path – 'make-up'

For gravel aggregate path builds outlined above the recommendation is for the following path 'make-up' to comprise:

- Subbase – 250-500mm depth of 75mm down / 3" crusher run stone
- Surface – approx. 40-50mm depth of 0-8mm quarry dust. In some cases, this may be up to 25mm. Surface mix will ideally be to a ratio of 3:1 (20–25mm : 0–8mm quarry dust). This will depend on what a local quarry can provide regards its mixing and screening capabilities.

6.2 Hardcore

Sections identified as requiring either upgrade of existing hardcore surface or new build of hardcore trail relates to areas requiring vehicular access for farm or maintenance vehicles only, e.g. forest road, farm access roads.

- Trail surface requirement: Compacted Gravel, approximately 3m width.
- Trail – formation and corridor clearance requirements: Scraping of existing gravel surface and overlying organic material to create level subbase and remove obstacles (roots, boulders etc.). Localised vegetation and soil clearance. Existing sub-base and bedrock is exposed in places.
- Trail construction technique: Surface to be constructed to withstand large forestry and farm vehicles.
- Maximum size of machinery to be used: To be kept to a functional minimum and to be agreed with the client for all sections in a method statement prior to construction. Machinery to be no wider than road width and to be suitable for ground conditions and steep side slopes where required.
- Structural features required: Drainage, topside ditching and culverting if required.

Figure 21 Example of vehicular access hardcore section on BBW

6.3 Bog bridge

Bog bridge provides an elevated 'floating' surface that provides dry passage through wetland areas on the BBW. This solution is particularly suitable for narrow trail corridors where boardwalk would not be appropriate to setting (e.g. inability to build adequate foundations in deep peat and environmental

constraints). Some areas have been identified as requiring replacement. In other sections installation of new bog bridge has been recommended to allow safe crossing of particularly wet and boggy areas and to tackle gradients in areas with these challenging ground conditions.

Figure 18 Simple bog bridge structure with sleepers

Bog bridge build consists of two base logs, or sills and large boards or planks called stringers. The stringers rest on top of the sills and are held together by spikes or long screws. See Figure 18 for illustration. Bog bridges can pass over short muddy spots or link together to extend across larger wetland areas. They are also able to address issues with sections of trail that require a built trail, that are wet and where there is a change in gradient. Figure 19 shows gradient being addressed at the Cavan Burren Park and also where bog bridge has been used to provide access to peatland, which is often wet underfoot, at Scohaboy Bog on the Ormond Way. Figure 20 provides examples of sections of the BBW requiring bog bridge.

Figure 19 Example sections of bog bridge - Cavan Burren Park and Scohaboy Bog

Figure 20 Replacement bog bridge required, and new build bog bridge is recommended

Bog bridge can be slippery under foot without inclusion of adequate grip in the build. It is recommended that any timber bog bridge installation includes a grip mechanism such as heavy-duty U-Nail fencing along the surface length to provide adequate grip. Recycled plastic bog bridge or boardwalk would require a slip-resistance surface specification such as ecogrip.

6.4 Boardwalk

These are wooden or recycled plastic structures that are commonly built to cross areas of sensitive or very wet ground. They are normally elevated above ground level.

Boardwalk is a recommended build type on the BBW in areas requiring:

- Access provision to sensitive sites where damage by increasing footfall will occur
- Safe passage along the trail line in areas currently assessed difficult or impossible to access otherwise
- To avoid changes to the hydrology of a site, where building an aggregate path might have an effect.

It will be the responsibility of the contractor to assess the required width of the boardwalk, the height above the ground and the need to have handrails or not, further to site assessments during pre-construction detailed design phase.

6.4.1 Timber Boardwalks

Timber boardwalks are defined as wooden structures raised above the ground in order to cross difficult terrain or areas where minimal impact on the ground is required. The raising of the structure also lengthens the lifespan of the timber as it is not sitting on the ground and coming into contact with water. Wooden structures should only ever be constructed of suitably treated quality timber of the correct dimensions. Timber boardwalk is subject to higher levels of maintenance than conventional trail

construction. Standing trees should never be used as part of any timber construction and round untreated timber is unsuitable for use in the construction of timber boardwalk.

6.4.2 Recycled Plastic

Recycled plastic will provide a longer lifespan than wooden boardwalks, and with less risk of becoming slippery. A recycled plastic boardwalk can also be installed at ground level to reduce its visual impact in the landscape as, unlike timber, recycled plastic does not rot. Boardwalks can avoid impacts to the hydrology of a wetland site which may be adversely affected by an aggregate path built directly on the ground. See Figure 21 for examples of recycled boardwalk in situ.

Figure 21 Examples of recycled plastic boardwalk, with and without handrails

6.4.3 Materials recommendation for BBW Boardwalk

For new build sections requiring boardwalk the QS costed recommendation is for installation of recycled plastic boardwalk. Existing sections containing timber boardwalk deemed to be in suitable condition have been noted as currently fit for purpose. In sections where small areas of boardwalk require repair it is recommended that like-for-like is used. Where larger sections require replacement, the recommendation is for a transition to recycled plastic.

The long-term aim is consistency along the trail length with a preference for recycled product where possible to ensure longevity.

NB: For boardwalks up to 2 m wide the standards below can be applied. However for boardwalks with a width of 2m plus, the structure should be appropriately designed.

Boardwalks should consist of the following key components –

Posts

Posts are used to fix the boardwalk to the ground. These should be -

- A minimum of 100mm x 100mm square x 1500mm length.

- Either treated timber or oak.
- Driven into the ground a minimum of 500mm.
- Firmly set into the ground with no movement possible once in place.
- A maximum of 2000mm apart.

Treads

The tread is the surface of the boardwalk. This should be made to the following specifications -

- A minimum of 80mm x 20mm square.
- Set a maximum of 10mm apart.
- Wider treads may be used but these should be treated with appropriate resins for grip.
- Fixed to the rails using galvanised 100mm nails.
- The width of the treads and therefore the boardwalk should be a minimum of 600mm and maximum of 1500mm.
- Where the width of the tread exceeds 600mm a third rail should be added to prevent flexing of the treads.
- Where treads overhang rails by more than 100mm, additional support will be required to prevent undue leverage on the treads.

Rails

Rails are required where the boardwalk is 1.5 m or more above the ground. When used, rails should be:

- A minimum of 100mm x 80mm square and a maximum of 4000mm long.
- Fixed to posts using countersunk 200mm stainless steel coach bolts. This aids in the removal of sections for repair or maintenance.
- Fixed a maximum of 500mm and a minimum of 100mm above ground level.

6.4.4 Non-slip surface

It is recommended that no use is made of chicken or rabbit netting, or plastic or metal mesh to make the surface of decking boards non-slip. Whilst inexpensive to install, over time, the netting or mesh breaks. This creates a trip hazard and maintenance issue and will ultimately cost more in the long-term. All recommended new build boardwalk should specify non-slip decking boards. These are specially designed to help prevent slips and trips and feature inbuilt grip strips in every board.

6.4.5 Example Board Walk Builds

It will be the responsibility of the contractor to assess and design specific requirement for each section further to a site visit to assess ground conditions. Outdoor Access Design Guide[2] produced by Paths for All and Scottish Heritage provides elevations and section plans for various board walk configurations and should be referenced as standard practice for boardwalk design.

6.5 Stone Stepping - areas of gradient

Stone stepping has been recommended as a construction type for multiple sections of the BBW. Stone stepping refers to flagstone steps interspersed with gravel sections or longer sections of flagstones. This is recommended for trail sections with areas of gradient (detailed within this section), and for trail sections on flat but wet terrain (please refer to Section 6.1.8).

Stone stepping in areas of gradient allows for artificial level changes that have been constructed to gain or lose height over steep ground. Key stones or 'anchor rows' of between 500mm x 500mm x 150mm in size are pitched on end into the ground at intervals of around 2m to 3m (depending on the gradient of the trail and slopes) and the intervening area is filled with sections of smaller stones (e.g. around 300mm x 300mm x 80mm to create a 'cobbled' effect) or compacted gravel (e.g. bench cut or raised camber).

Figure 22 shows an example of stone stepping interspersed with gravel sections on a Category 3 trail.

[2] https://www.pathsforall.org.uk/resource/outdoor-access-design-guide

Figure 22 Example of stone stepping with gravel sections to accommodate gradient incline

Figure 23 shows an example of a section of the BBW that has been recommend for stone stepping and gravel build to provide a curved trail with switchbacks.

Figure 23 Stone stepping required due to gradient - gravel trail with stepping for switchbacks

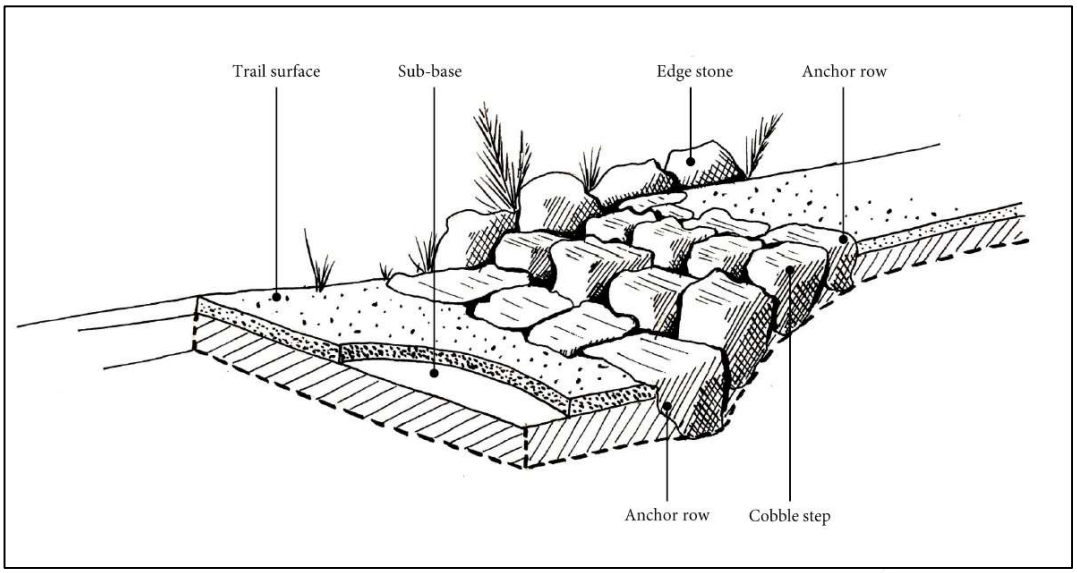


Figure 24 Stone stepping to provide artificial level change

Figure 24 above illustrates a potential composition of stone stepping sections, utilising anchor stones to secure trail surface layers across the level changes. See examples provided in Figure 25.

Figure 25 Anchor stone stepping with gravel trail and stone stepping with gravel trail

6.5.1 Stone Stepping - Flat terrain

In some sections of the BBW stone stepping is required to provide a sustainable and durable trail surface across wetter areas on flatter terrain. This will either require a combination of stone and gravel, as outlined above, or on long stretches crossing flat and wet grounds unsuitable for excavated trail build, continuous flagstone paving may be deemed appropriate.

6.5.1.1 Flagstone Paving

Flagstone paving is where large, flat and relatively thin slabs or flagstones are used to, in effect, 'pave' the trail. This must only be done with stone of not less than 500mm x 500mmm x 100mm. Flagstone pitching can only be used on trails of Category 3 and above. Flagstones must be set on top of compacted substrate only and not on organic material of any kind. It is essential that all flagstones used in flagstone pitching are not less than 150mm thick and have surfaces without significant level changes. In addition, flagstones must not move in any way once they are set in place and stability must be ensured. Flagstone pitching can be very useful in developing trails in areas of poorly drained ground and can also be useful in developing trails where excavations must be minimised. Figure 26 shows successful installation of flagstone paving to provide a durable walking surface across boggy ground on the Pennine Way.

Figure 26 Flagstone paving on the Pennine Way (© Becky Angell) and continuous stone stepping

6.6 Stone Pitching

Stone Pitching has been recommended in some upland areas of the BBW where severe gradients are encountered. It is a technique used where aggregate is impractical or has failed due to the gradient and where the erosive pressure of feet and water has taken its toll. The pitched stone surface can withstand these pressures, and, with sensitive construction can blend aesthetically with the surrounding landscape.

Stone pitched paths should merge naturally with the rocky appearance of the landscape and provide an easier route than the surrounding ground. To enhance the aesthetic appearance, they should avoid steep straight lines, and incorporate curves and variations in width, making use of natural features wherever possible.

Stone pitching must be completely stable with no risk of subsidence and should only be placed on top of suitably compacted mineral soil and not onto organic material of any kind. Consideration must be given to ease of use. A pitched path does not absorb impact, and may be steep, rough and therefore provide an uncomfortable walking surface to the user. If the surrounding ground is easier, or more comfortable to walk on users will cause further erosion by creating short-cuts or 'desire lines'. An alternative of short vegetation will invariably be used if it is available. A comfortable walking surface is therefore essential which means that treads need to be at a low angle to avoid becoming slippery when wet or icy. It is also very important to ensure that site restoration and landscaping encourages people to stay on the path.

Figure 27 Existing section of BBW identified as requiring stone pitching

Figure 27 shows an existing section of the BBW for which stone pitching is recommended in order to provide a solid and durable trail surface. Figure 28 below shows examples of good practice stone pitching.

Figure 28 Examples of classic stone pitching in upland environment

Scree is a precarious mass of small loose stones that covers some mountain surfaces, and this requires a specialist type of stone pitching . Scree sections are built from surrounding stone to be contained with a hand excavated path tray, with anchor stones used to cover gradient. The visual below illustrates ongoing works on Croagh Patrick, Co. Mayo.

Figure 29 Scree pitching in progress on Croagh Patrick

6.6.1 Stone Pitching Construction

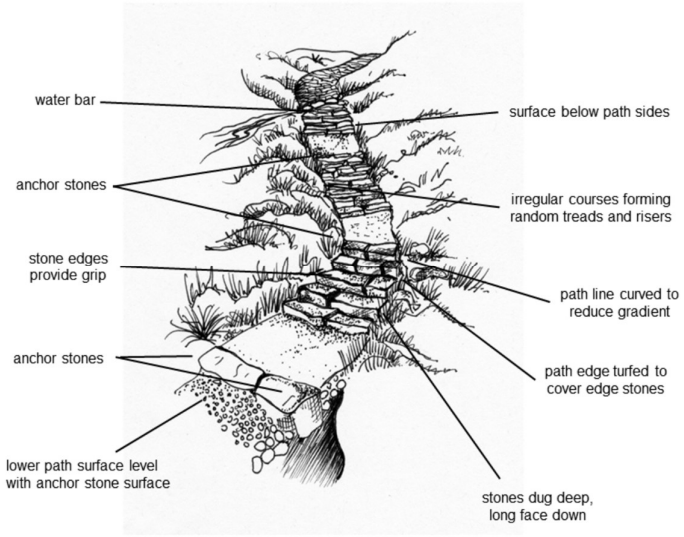


Figure 30 Stone pitching construction illustration, Scottish Uplands Path Construction Guide

There are varying styles of pitching, attributed predominantly to the stone type available. The basic principles for construction remain the same, as illustrated in Figure 30. The construction process is outlined in Figure 31:

Step 1
Form a path tray

- excavate a path tray along the selected trail line
- existing trail erosion may require infilling or narrowing without excavation

Step 2
Set the piched stone

- Starting at the bottom and working uphill
- Set large anchor stones flush with lower path surface
- progress upwards pitching stone into the tray in rough courses to achieve required random footholds and risers
- user large deep stone to form edges
- wedge all gaps firmly so path is immoveable
- pack remaining gaps with smaller stone and gravel
- incorproate drainage as required

Step 3
Edge finishing

- use turf, boulders and spoil from path tray excavation to landscape path edges
- ensuring that edge stone side faces are covered, the line is defined, and the appearance "softened"
- where necessary the edge finishing should raise the path sides to contain path use, particularly to avoid short cutting at cornersuse excess turf and spoil to re-instate eroded or damaged ground

Figure 31 Basic construction process stone pitching

6.6.2 Stone Pitching Summary Considerations

Design a trail line that fits the landscape and requires the minimum amount of pitching, with the following considerations:

• Provide a good surface for users allowing walkers to place a whole foot on a single tread wherever possible. This is particularly important on descent.
• Produce a structure that is solid and immovable, and will withstand the most extreme pressures of use and water flow.
• Incorporate drainage features for a path surface that will not be under-mined, will be long-lasting and require the minimum amount of maintenance.
• Ensure that the bottom step is flush with the path as this stone will become higher than the aggregate below due to the compaction and migration of the aggregate.
• Landscape carefully to further encourage walkers to stay on the path.

6.7 Stone Stepping and Stone Pitching – Type of Stone

The type of stone used for stepping and pitching must be appropriate to the environment where it is to be used. This should be agreed with the Trail Developer prior to installation. The ultimate aim is to use block stones that will appear natural, and blend with the particular landscape. The local stone selected should be in its natural form, and preferably weathered

6.8 Additional Trail Features

These are additional trail features that may be required but will need to be identified through detailed design undertaken by the contractor pre-construction.

Audits have specified where certain drainage solutions are required, specifying a requirement for culverts or water bars. It will be the responsibility of the contractor to assess the need for drainage and drainage type, during their assessment of the relevant trail section.

6.8.1 Culverts

A culvert is a pipe or box-like construction of wood, metal, plastic or concrete that conveys a stream under a trail without constricting water flow. Pipes must be set on a firm base that will not subside or settle and must be held in place by suitable revetment structures, i.e. headwalls extending from the base of the drain to a minimum of 100mm above the top of the pipe. Headwalls must be made of

imported natural stone only. Where a culvert is inappropriate or unsuitable, it may be necessary to install a short wooden bridge to span the gap. Figure 32 provides examples.

Typical culvert sizes are noted below:

- Twin, stone headwalls (as shown in the examples below).
- Small – 300mm diameter.
- Small double – 2No. 300mm diameter.
- Medium – 450mm diameter.
- Large – 600mm diameter.

Figure 32 Examples of culverts with twin headwalls

6.8.2 Water bars

Water bars are used on unbound surfaces to prevent scouring. They are built across the path on slopes with a 'shedding bar' to catch running water and to divert it off the surface. However, by creating a raised bar across the path to intercept water you will be introducing a physical barrier. For that reason, water bars should only be used as a 'last resort' where other drainage solutions are not deemed appropriate. Water bars should be installed when the path is constructed or upgraded, but can be installed on existing paths as an erosion control measure.

For water bars to catch and disperse water effectively they must be carefully positioned on the path. This depends on where water is coming onto the path, expected water volume and good dispersal areas – where water will not flow back onto the path further down. A 'liner' - a row of level stones - should be installed on the uphill side to prevent undercutting of the shedding bar. Water bars do require ongoing maintenance – an annual inspection is required to ensure the bar is functioning and in safe and good conditions, and whilst a well-constructed water bar should be solid, immoveable, and 'self-cleaning' it may need regular removal of build-up of surfacing or debris (e.g. leaf litter). See Figure 33.

Figure 33 Examples of water bars incorporated in new build gravel trail

6.9 Revetments

A revetment is a type of retaining wall that is built using natural stone. It is a key component of trails construction on steep and/or unstable slopes or where making up levels is required.

Revetments and associated fill can lead to trails becoming in-sloped, resulting in further retention of ground and surface water which can lead to a failure of the structure.

Revetments must only be constructed on stable mineral soil and there must be no threat of subsidence or water retention. They must be able to bear the weight of both the trail structure and the trail user. See Figure 34 for examples.

Figure 34 Examples of stone revetments

6.10 Turns

Turns are where the direction of the trail shifts or changes significantly. Turns can be used for a variety of reasons including –

- To change direction to get to a particular place
- To gain or lose elevation when on a steep side slope

In areas identified as requiring new trail build, the contractor may need to incorporate turns in the pre-construction micro-design phase.

The type of turn that is used in trail design will generally relate to the steepness of the side slope and the width available to make the turn. Turns are frequently the location of erosion either caused by water on the trail or by use. It is therefore crucial to ensure that the correct turn is identified in the trail design to limit the level of erosion on the turn.

There are three types of turns as follows:

6.10.1 Climbing turns

Climbing turns are generally used on flatter side slopes of less than 10%. They are wide and flat. See Figure 35.

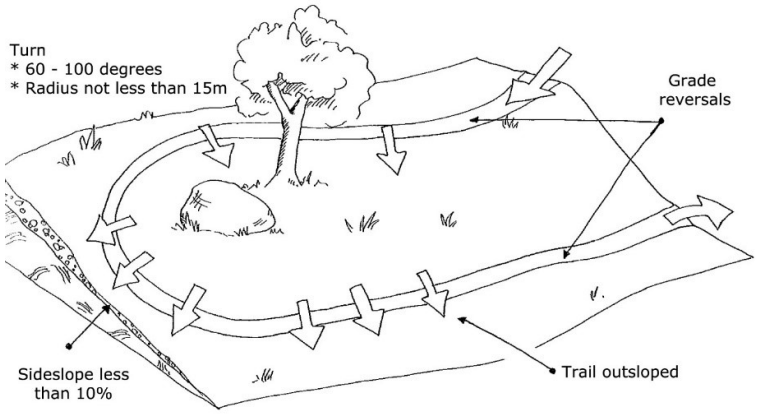


Figure 35 A climbing turn

6.10.2 In-sloped climbing turns

This type is generally used on steeper side slopes of up to 20%.

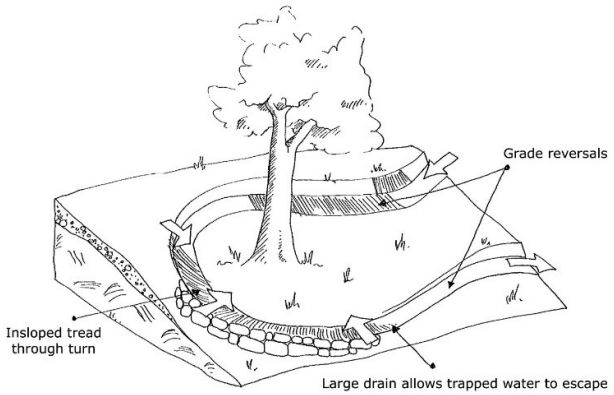


Figure 36 An in-sloped climbing turn

6.10.3 Rolling crown switchback

A switchback reverses direction with the help of a relatively level constructed landing. Therefore, the turn itself is on a crowned platform which has been built by bringing the lower leg of the turn up to meet the upper leg by building a revetment. They are difficult to build but are much more durable on steep slopes than climbing turns and can be used on side slopes over 10% and up to 70%. Figure 37 illustrates this.

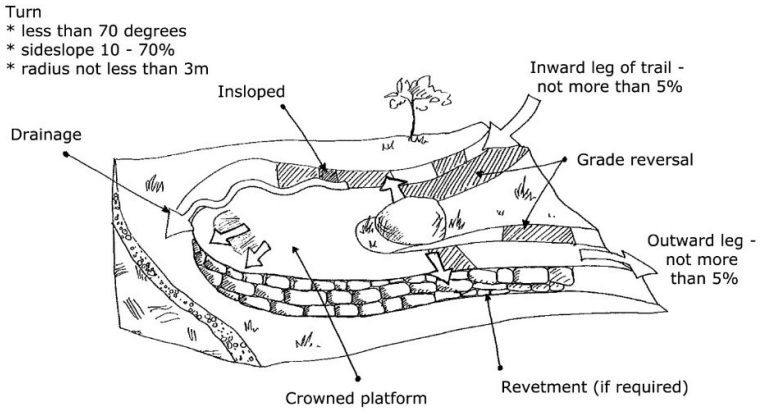


Figure 37 A rolling crown switchback

6.11 Upland and Remote Sections

Sections of the route that are remote from settlements or public roads have been defined as “remote rural” rather than upland. Upland areas might typically include land over 350m altitude, but there are low lying areas of Beara Way that are challenging terrain. A path could be constructed as ‘upland style’

in these areas based on a strategic approach to development so that there are no sudden changes in construction style in or near to settlements or roads / tracks.

Characteristics of these areas include any combination of: steep gradients, rough terrain, exposed bedrock, deep peat, more than a kilometre to vehicle access, sensitive habitats etc.

6.11.1 Construction Standards 'Remote/Upland' Sections

Path design needs to vary according to the terrain and the surface could be anything from 300mm wide (for very short lengths) to 1200mm wide. For a 'longer journey' people travelling together may reasonably expect to walk two abreast in most places and lack of opportunity to do so my result in people trampling the path edges. Development to date on the BBW appears to have resulted in wide paths, many of which have been 'built' with machinery.

Where there are mineral soils, aggregate paths and stone pitching on gradients above 30% are the most appropriate solutions. It will be necessary to plan and incorporate surface drainage features to keep the path free from flooding and prevent erosion of surfacing. All work in remote rural areas should take account of the Upland Path Advisory Group standards for Upland Pathwork – the approach to construction and techniques within this manual should inform any future development.

Stone pitching is constructed using interlocking boulders as a walking surface and requires large quantities of sizeable boulders to be available in the vicinity of the path, or for boulders to be transported by helicopter from a nearby location. Quarried stone needs to be carefully specified and selected to avoid use of inappropriate stone. Construction requires highly skilled labour and pitched paths cannot easily be built by machine. The use of individual stone 'steps' can be problematic if they are not properly anchored, especially on soft ground.

Pitching can be difficult to achieve on large expanses of exposed bedrock, which then makes the definition of a path line more challenging. Some rock types are poorly suited to use for pitching or as a natural surface of bedrock – this includes some types of schist or slate, which have high mica content, or fine-grained sedimentary rocks, as they tend to be slippery when wet. See also Section 6.6.

6.12 Infrastructure

Trail Audits identified requirements for the following types of infrastructure.

6.12.1 A-Frame Stile

Where trail audits have assessed the requirement for a A-Frame stile, the recommended specification is for galvanized stainless steel, as per the existing examples on the BBW (see Figure 38).The A-Frame stiles come in both standard kit sizes or can be made to measure dependent on requirement.

Figure 38 Left Stile on Beara Way section, BBW stile on Leitrim Way

This is the specification for stock-proof stiles currently used on this trail. A stock-proof stile provides walkers with a means of negotiating fences without interference with the fence during erection or use, and without compromising boundary fences or their stock-proof nature. Trail audits identified some stiles require replacing as are no longer fit for purposes. The recommendation is that the existing specification is retained for future development of the BBW.

6.12.2 Step over stile

Where trail audits have assessed the requirement for a step over stile, the recommended specification is for recycled plastic, as per the example below in Figure 39.

Figure 39 Example of recycled plastic step over stile

6.12.3 Pedestrian gate

Where trail audits have assessed the requirement for a pedestrian gate, the recommended specification is for galvanized stainless steel with a self-closing mechanism, as per the examples shown in Figure 40.

Figure 40 Examples of pedestrian gate – galvanised stainless steel

6.12.4 Kissing gate

Where trail audits have assessed the requirement for a Kissing gate, the recommended specification is for galvanized stainless steel with a self-closing mechanism, as per the examples below in Figure 41.

These are available with either a curved enclosure or rectangular. It will be the responsibility of the contractor to assess the type most suitable for each given site.

Figure 41 Kissing gate, curved enclosure and rectangular enclosure

6.12.5 Farm Gate

Where trail audits have assessed the requirement for a farm gate (single or double), the recommended specification is for galvanized stainless steel, as per the example below in Figure 42.

Figure 42 Example of galvanised stainless steel farm gate

6.12.6 Footbridge

Where trail audits have assessed the requirement for a bridge, a size has been provided and the recommended specification is for recycled plastic. This is suitable for bridges of standard 'kit' design up to 4m. Bridges larger than 4m will require ground surveys to inform detailed bespoke design.

Some locations will list a specific requirement for footbridge with step stile at end to ensure containment of cattle. These have been costed accordingly. Figure 43 is an example of an existing bridge with step stile along the route.

Figure 43 Example of recycled plastic bridges

6.12.7 Stock Fencing

Where trail audits have assessed the requirement for fencing, the recommended specification is for stock proof post and wire fencing with barbed wire, as per the example below in Figure 44.

Figure 44 Post and wire stock fencing with barbed wire

7 SUMMARY

Sustainable trails complement the natural environment in that they do not have a negative impact on land use or habitats and provide opportunities for a diverse range of people to access the outdoors to enjoy and learn about their natural environment. This document has provided a brief snapshot of the process that should be applied when developing trail sections of the BBW. If these trail works are undertaken in a sustainable way, they will exist for generations to come and be an asset to those involved in managing the trail.

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