RODERICK DHU VIEWPOINT

Path Reinstatement Proposal

A.C.T Heritage Ltd.

CONTENTS

1. Introduction

A.C.T Heritage have been invited to survey and construct a viable path proposal, on behalf of the Steamship Sir Walter Scott Trust, for the reinstatement of a historic path from the Trossachs Pier main car park to the 'Roderick Dhu' viewpoint, situated around a rock outcrop to the west of the pier facility. This document is designed to give an informed proposal of design and construction of the renewed and upgraded visitor experience access path.

2. Background

Located in the heart of Loch Lomond and Trossachs National Park, Loch Katrine is approximately 10 miles west of Callander and 7 miles north of Aberfoyle. Loch Katrine has been the primary drinking water reservoir for much of the City of Glasgow since the late 1800's.

Loch Katrine has been operating as a visitor attraction and destination since Victorian times. Queen Victoria famously visited in 1859 to open the newly completed water works and as a result, has been a popular tourist destination ever since.

Home to the steamship Sir Walter Scott, the Trossachs Pier complex located at the eastern end of Loch Katrine and provides a focal point with café, walks, cycle hire and car parking facilities for a range of events and recreational experiences all year round.

As part of the Trossachs Visitor Management Project being coordinated by the Steamship Sir Walter Scott Trust, an opportunity has been identified to reinstate the path to the historic Roderick Dhu viewpoint and site of the former watchtower. This scheme includes the design and installation of a new timber viewing tower and associated board walks which are an integral part of the path and viewpoint proposals (see separate report). This will add to the range of walks available for visitors to the heart of the Trossachs and the busy Trossachs Pier visitor destination as well as helping to relieve some visitor pressure on the loch shore walk and nearby hill climbs.

Walking directly from the car park for a short distance to a prominent rocky outcrop above the pier, the Roderick Dhu' viewpoint is believed to have been popular dating back to Victorian times. The viewpoint affords stunning views along the length of Loch Katrine. The path itself is known to have existed as recently as the 1980's but has however fallen into disrepair. The below painting is by John Knox circa 1820 and depicts the rocky outcrop and viewpoint above the pier with a watch tower. The name 'Roderick Dhu' which is attributed to the watchtower, comes from Sir Walter Scott's narrative poem 'Lady of the Lake' as supposably Roderick Dhu being one of the antagonists vying to win the love of Lady Ellen Douglas.

The area in which the path and viewpoint are situated are designated under the *BEN A'AN AND BRENACHOILE WOODS SITE OF SPECIAL SCIENTIFIC INTEREST* which is a statutory designation made by NatureScot (formerly Scottish Natural Heritage – SNH) under the Nature Conservation (Scotland) Act 2004.

Additional to the SSSI citation, the area is also designated as part of Trossachs Woods Special Area of Conservation (SAC) for the European habitats listed as Western Acidic Oak Woodland.

Landscape with Tourists at Loch Katrine by John Knox circa 1815-20
Photograph by Antonia Reeve *Photo credit: National Galleries of Scotland*

3. Path Survey

The survey has been undertaken using various items of equipment including ranging pole and clinometer to measure slope, wheel to measure distance; a tape measure to measure path width and a digital camera to show specific items of works and the path line. For simplicity, the survey has been hand drawn on the attached survey sheets with relevant identification references and item symbols. Reference photos are included within survey attachments.

The path condition survey is designed to provide an overall assessment of the current condition of the path line and to give a design and specification of what techniques will be used to construct the upgraded path. A 'Bill of Quantities' is also included within the appendix, itemising all aspects of the work required to deliver the proposed path.

4. Path construction – Rationale and techniques

Modern Hand Build Upland Path Construction Techniques have been developed over the last 30 years. Many of the techniques have been adopted through 'rediscovering' the techniques used during construction of 'Stalkers Paths' in the mid to late 1800s. Many of these paths were generally built with hand dug aggregate material for surfacing and protected with stone-built drainage features.

Due to the sensitivities of the site to be developed, a fully 'Hand Built' path construction permissions would be sought. Given that the area is within designated sites for woodland habitat, the least disturbance to any ground will be favourable. All hand build techniques are tried and tested and fully specified within the Upland Path Advisory Group (UPAG) guidelines (revised 2015) and any contractor will be expected to be fully conversant with these techniques.

The path can be split into 4 discernible sections; all of which are fully detailed within the specification sheets included within the appendix. The path will run for approximately 188m from start at carpark OS GR NN 4594 0717 to termination at viewpoint at OS GR NN 4945 0725. There follows a brief synopsis.

- Section 1 – circa 35m. From car park to flat terrace before rockfall area will, due to slope, require a comprehensive stone pitching solution. This will address the sensitivities of the slope where mature trees are most populous and will also minimise any ground disturbance through excavation thus keeping root disturbance to a minimum.
- Section 2 – circa 72m from terrace to Boardwalk section. This section will be a mix of aggregate surfaced path and stone pitching to address gradient fluctuations. The aggregate surface will 'float' on a geotextile material which will allow drainage and prevent path slippage and muddying. Additional drainage features i.e. water bars and X-drains and/or culverts will be installed to manage water run off and reduce maintenance requirements.
- Section 3 – circa 20m from end of section 2 to final accent, it is proposed to install a section of boardwalk to raise the path above the natural flush thus preventing and changes to the hydrology of the flush by way of installing drainage channels or blockages from a 'raised bench style' path.
- Section 4 – circa 61m. As section 2. From boardwalk to viewpoint. A mix of aggregate and pitching to reach final destination at the Roderick Dhu viewpoint.

In addition to the above path construction, it is also envisaged to install an interpretation panel at the start of the walk to provide historical background and general area information. Also, for user safety, to prevent accidental egress directly into the carpark, a 'Half Barrier' will be installed at the bottom/start of the path. Examples of both are illustrated below.

Example: Half Barrier as installed at entrance to nearby Ben A'an footpath

Example: Information panel as installed at nearby Ben A'an car park

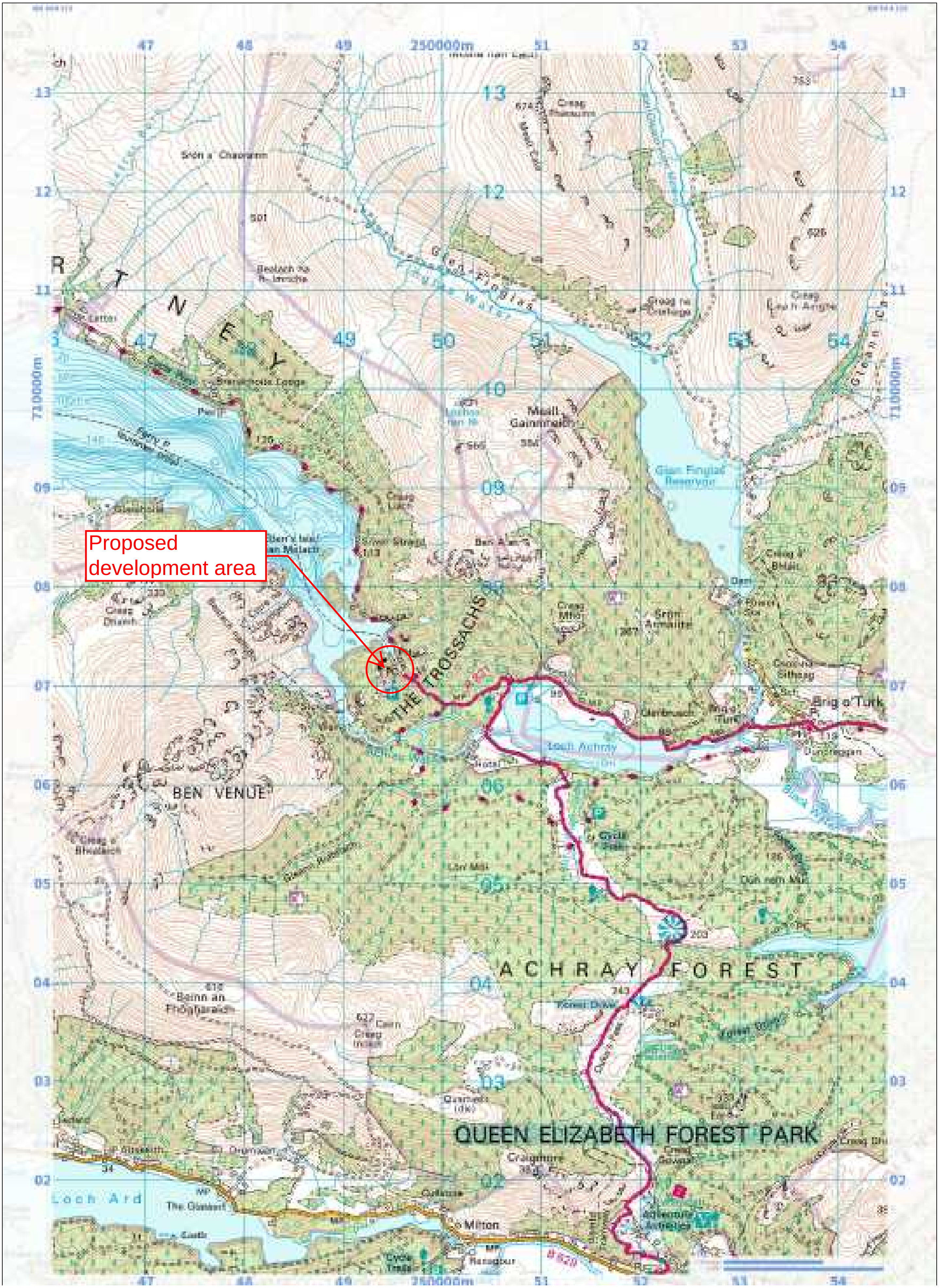
Appendices

a. Location Maps
b. Path survey and specification sheets
c. Bill of Quantities
d. CMS (Construction Method Statement)
e. Wetland Typology – Field Survey
f. Half Barrier example technical sheet – *Courtesy of Outdoor Access Design Guide*

Roderick Dhu Path Reinstatement

Map shows indicative path line @ 1:5000 (approx.)


Silver Strand
Bealach an Duine
s Isle/
Molach
Am
Priosan
Meml
Waterfalls
116
Feith na
Cailliche
Allt na Cailliche
Sgiath nam
Mucan Dubha
Otter
Island
Pier
Start NN 4594 0717 to
end at NN 4945 0725
The
Trossachs
113
A821
Meall
an Leim
Sluice
Dam
Craig
Leven
230
Pass of Tross
102
MP
Achray Water
Ford
Weir
Pass of Achray
FB
153
Gardh
Innis
Achray Water
454
250000m
49
08
07


Proposed development area
THE TROSSACHS
ACHRAY FOREST
QUEEN ELIZABETH FOREST PARK
BEN VENUE
Glen Finglas Reservoir
Loch Achray
Brig o' Turk
Loch Ard
Milton
Meall Gainmheich
250000m
710000m

PATH NAME/LOCATION: RODERICK DHU PATH REINSTATEMENT

Sheet: 5

Date: 15 SEPT 20

Weather: RAIN

Surveyor: GRJ

G.R. Start: NN 4954 0717 (CARPARK)

G.R. End: NN 4945 0725 (WARRIOR)

Section: 4·2

A.C.T HERITAGE

Dist (m)	Grad (x°)	Path width (m)	Existing Path Features	Grad (x°)	Path width (m)	Work Required	Description
0	ENDS		EXPECTED WATCHTOWER. ENDS ENDS			ENDS	8NOS ANCHOR BAR (FLUSH)
20				REF PHOTO 19.		A/BAR	3NOS LINER BAR
1.95							7M REVETMENT
			BOULDER	REF PHOTO 17 & 18		A/BAR	2M BLOCK STONE PITCHING
			ROAD MARK E171			WATERBAR	28M AGGREGATE PATH
	5 (RISE)					2M PITCH & ROAD MARK A/BAR	
			BEND			A/BAR	
						WATERBAR	NOTES: FULL LENGTH SECTION WIDE ENOUGH TO BENCH @ 1·5m FULL LENGTH.
(165)			BOULDER			165	
						REVET EDGE TO 165m	
			SLOPE SECTION OF PATH REQUIRING TO BENCH	REF PHOTO 16			
159							

PATH NAME/LOCATION: RODERICK DRIVE PATH REINSTATEMENT

Sheet: 4

Date: 15 SEPT 20

Weather: RAIN

Surveyor: GPJ

G.R. Start: NN 4954 0717 (CARRIAGE)

G.R. End: NN 4945 0725 (VIEWPOINT)

Section: 4.1

A.C.T HERITAGE

8m Block Stone Pitching

8m Stone Revetment Fully Landscaped

3 No. Water Bar

23m Aggregate Path

Dist (m)	Grad (°)	Path width (m)	Existing Path Features	Grad (°)	Path width (m)	Work Required	Description
23							
158			REF PHOTO 15			WATERBAR	
	5°				1.5m		
			PEAT/DITCH			WATERBAR	
		0-3				2m Block Pitching	
						@147	
8			PATH ENDS				
155			RD LEFT 2 OVER	REF PHOTO 14			
		0-3				REVET ROCK SLOPE	
			VEGETATED SLOPE			BLOCK PITCHING	
	15° (MAX)					@153	
		0-3	MINERAL SOILS		1.5m.	REVET ROCK SLOPE	
			TERRACE				
		0-3	SLOPE			WATERBAR @151	
				REF PHOTO 13		BLOCK PITCHING REVET ROCK SLOPE	
127.			BOULDERWORK				

PATH NAME/LOCATION: RODERICK DMU PATH REINSTATEMENT — Sheet: 3

Date: 15 SEPT '20 — Weather: RAIN — Surveyor: GAL

G.R. Start: NN 4954 0717 (CULVERT) — G.R. End: NN 4945 0725 (TURNPOINT) — Section: 2.2

A.C.T HERITAGE

Dist (m)	Grad (°)	Path width (m)	Existing Path Features	Grad (°)	Path width (m)	Work Required	Description
12			FALLEN TREE			PATH TURNS TO RIGHT AT END JOINS TO BOARDWALK (BY OTHERS) BOARDWALK CIRCA 20M	PATH SECTION 3.5M. MIX 40/60 PITCHING & AGGREGATES TO FIT/ACCOMODATE CHANGES IN GRADIENT.
107							16M BLOCK STONE PITCHING
	12° (AVG)	0.5M TARMAC		REF PHOTO 12		A/BAR, DREN, LAYERBAR	14M AGGREGATE PATH
						A/BAR, DREN	2NOS 300MM TWIN WALL CULVERT W/C HEAD WALL STONES.
23				REF PHOTO 11			2NOS LAYERBAR
95						A/BAR	7 NOS ANCHOR GAR — ANCHOR GAR STONE TO BE FLUSH WITH SURFACE IF STEP REQUIRED, ADDITIONAL STONE TO BE INSTALLED LOWER STEP
			GRASS/BRACKEN, GRASS/BRACKEN, VERY SOFT GROUND			DREN, A/BAR	NOTES:
	15° (AVG)	0.5M TARMAC					FROM 107M TO 127M (STRAIGHT LINE) BOARDWALK THROUGH FLUSH TO BE INSTALLED BY OTHER.
				REF PHOTO 10		LAYERBAR, A/BAR, DREN	
72			CONTINUED PAGE 2.				

PATH NAME/LOCATION: RODERICK DHU PATH REINSTATEMENT

Sheet: 2

Date: 15 SEPT '20

Weather: RAIN

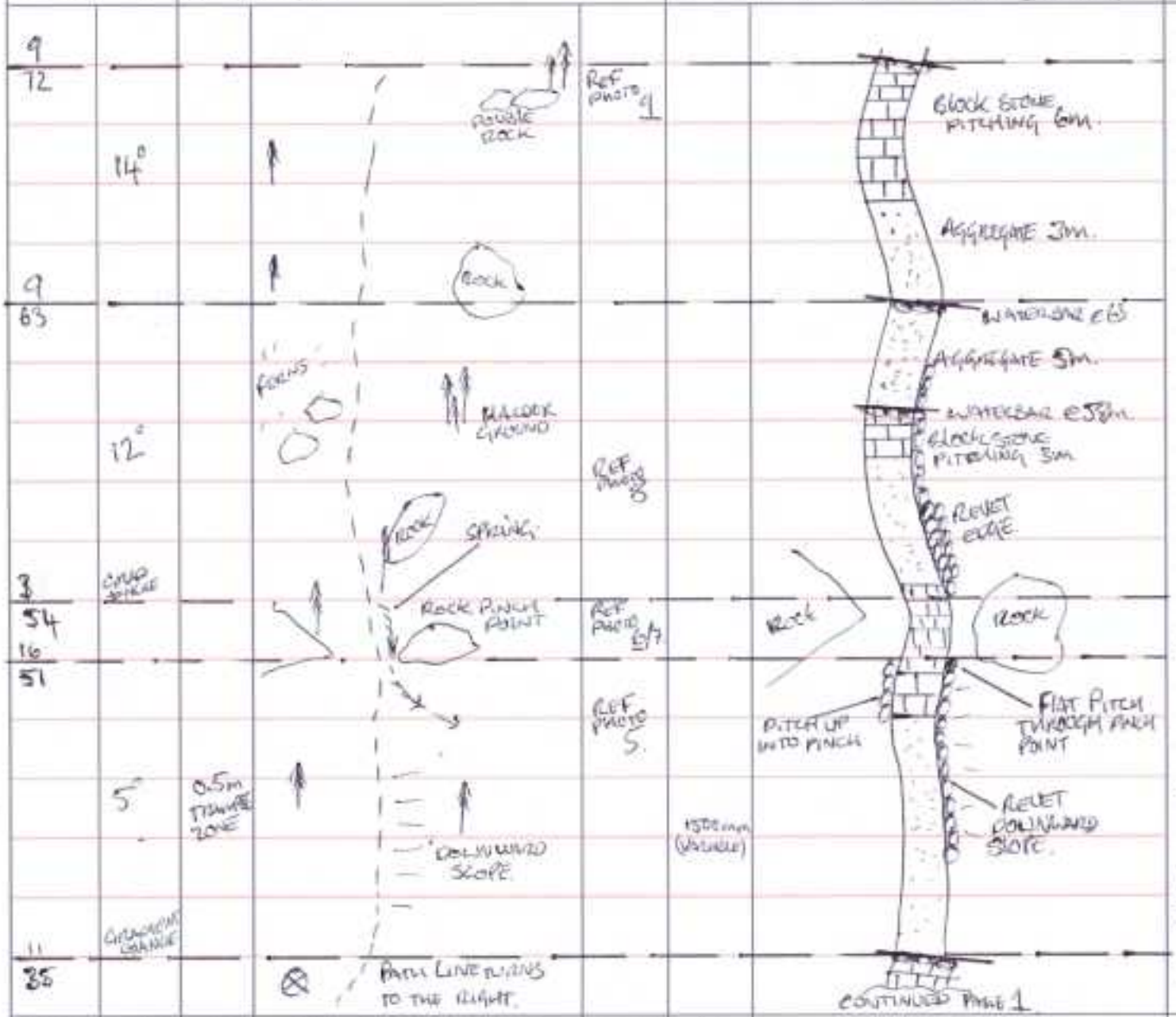
Surveyor: GRJ

G.R. Start: NN 4954 0717 (CAL ACK)

G.R. End: NN 4945 0725 (VELUXINT)

Section: 2.1

A.C.T HERITAGE



14m BLOCK STONE PITCHING

3NOS WATER BAR

23m AGGREGATE PATH * SEE SPECIFICATION FOR GUIDE

26m STONE REVETMENT FINISH LANDSCAPED

ROCK PINCH POINT REQUIRES WIDENING TO CREATE SUITABLE WIDTH.

* AGGREGATE SPECIFICATION.
PATH TO BE 1.5m WIDTH WITH GEOTEXTILE BASE TO FLOAT PATH.
150mm DEPTH 'TYPE 2' MATERIAL INFILL
25m FINES TOP COAT.
COMPACT TO REFUSAL.
CROSS-SHED FINISH

Dist (m)	Grad (x°)	Path width (m)	Existing Path Features	Grad (x°)	Path width (m)	Work Required	Description

PATH NAME/LOCATION: RODERICK DRIVE PATH REINSTATEMENT

Sheet: 1

Date: 15 SEPT '20

Weather: RAIN

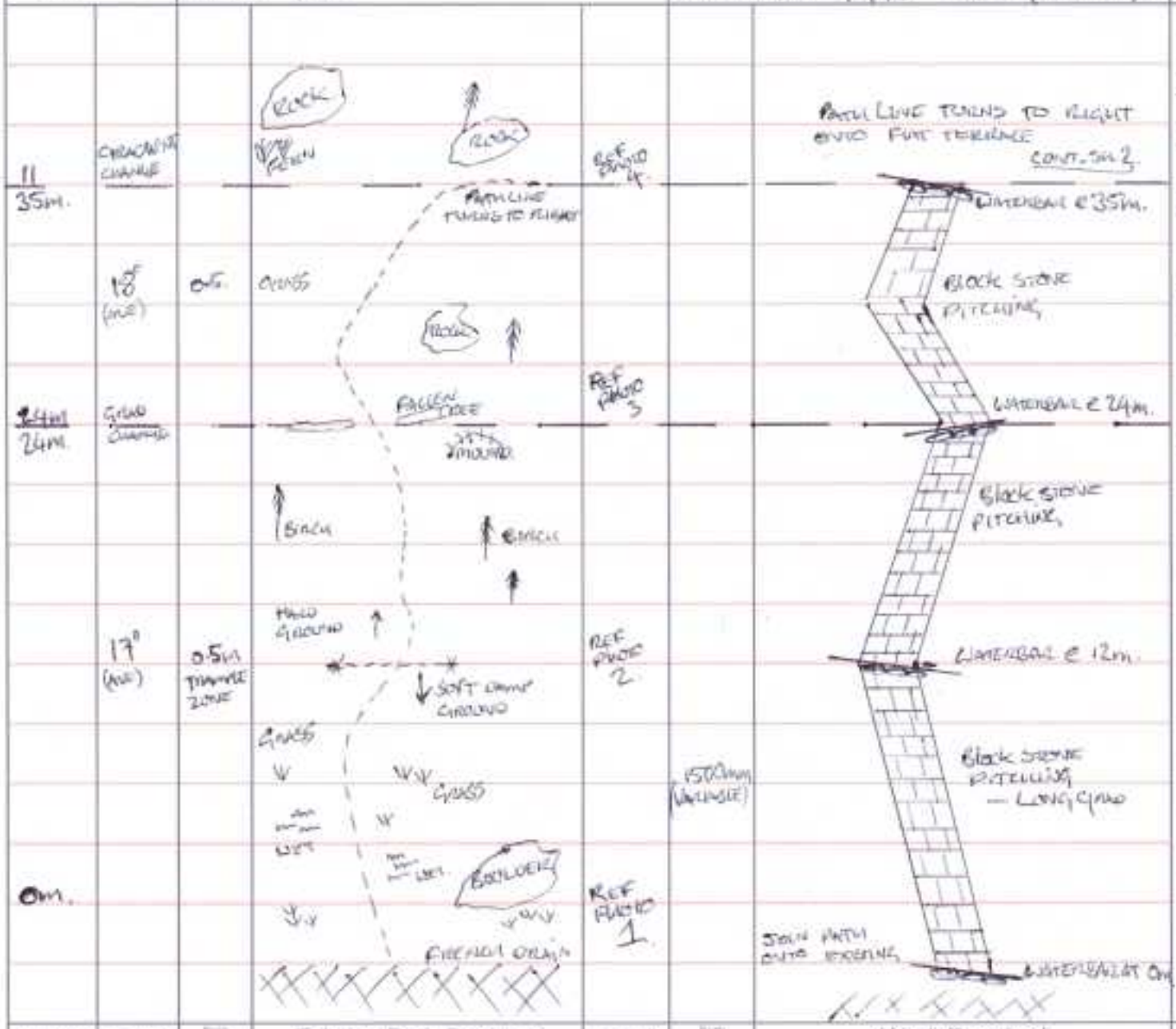
Surveyor: GRL

G.R. Start: NN 4954 0717 (CARPARK)

G.R. End: NN 4945 0725 (VIEWPOINT)

Section: 1

A.C.T HERITAGE



35m @ 1.5m WIDTH VALLEY +/- 200mm BLOCK STONE PITCHING

4 NO. WATERBAR WITH DISCHARGE BUND

ALL EDGES FULLY LANDSCAPED

REFERENCE PHOTOS 1 THROUGH 4 SEE ATTACHED SHEET(S)

NOTES:

PITCHING SHOULD COMPLY WITH IMPG (2016) GUIDELINES.

PITCHING SHOULD USE "LONG GRADIENT" STYLE TO REDUCE STEP HEIGHT.

WATERBARS SHOULD INCORPORATE DISCHARGE BUNDS TO PREVENT WATER EGRESS BELOW.

Dist (m)	Grad (°)	Path width (m)	Existing Path Features	Grad (°)	Path width (m)	Work Required	Description

Photo 1: start of path at car park

Photo 2: Soft wet grasses/mosses with surface breakage

Photo 3: Fallen tree / mound

Photo 4: Top of pitching section / change in gradient

Photo 5: entrance to pinch point; ground hard underfoot.

Photo 6: pinch point entrance; rock on RHS can be trimmed/removed

Photo 7: Coming out of pinch point.

Photo 8: Coming out of pinch point; note tree on RHS, spring shows after rain.

Photo 9: double rock formation at 72m. Soft ground trample zone.

Photo 10: General trod line; ground quite soft, heavy grasses

Photo 11: slight increase in gradient; pitching solution required

Photo 12: end section 3 – approximate section/line of sight for boardwalk

Photo 13: end of boardwalk; steeper section with mineral soils visible

Photo 14: pitching section after flat terrace. Note bedrock to RHS at tree

Photo 15: easy gradient; predominantly peat and heather/blaeberry

Photo 16: area of path edge subsidence

Photo 17: 2m pitching area at dead birch.

Photo 18: prominent dead birch as focal point

Photo 19: path termination area (expected watch tower)

ITEM	WORKS DESCRIPTION	UNIT	QTY
1	**Aggregate Path:** Construct aggregate path, 1500mm average width / 150mm Type1/2 sub-base / 25mm (1:50 camber or cross shed where landscape allows) fines top coat. Compact to refusal. Landscape spoil and form edges.	m	93.00
2	**Anchor Bars:** Construct stone built anchor bars across the full path width. To extend 150mm each path edge, and be flush with the path surface. The stone will form an independent structure to reinforce the aggregate of the path and pressure of use. Only weathered tops are to be visible.	each	15.00
3	**Water Bars:** Construct water/detritus shedding bars;. between 30°- 45° to the path line. Bar depth should be a minimum of 100mm rising to approximately 150mm but not be obstructive. Liner should provide a draining fall of 5° minimum. Extend by 300mm on each path side. No gaps between bar stones.	each	15.00
4	**Open Side Drain:** Excavate drainage ditch 300mm deep and 300mm wide at base, chamfered to 500mm wide at top. Ensure that water drains freely along the ditch and away from path. The base of the drain should be turf lined to prevent scour and reduce visual impact.	m	45.00
5	**Pitching:** Construct rock / boulder pitched path to a variable width 1500mm +/- 200mm. Irregular, random treads must be comfortable to use over an even gradient. Maximum riser height to be 150mm (6 inches). The construction must be solid with stones fitting tightly, well packed, with overlapping joins. Use excavated turfs, spoil and boulders to define and contain the path edge. Rock to be well set into the ground at least 300mm with a level treading surface.	m	75.00
6	**Revetment**: Construct retaining revetment wall to stabilise the slope below path. The construction must be solid and stable, with large foundation stones, off-set joins, pinned and backfilled firmly. Pack gaps between the courses with turf and fully landscape.	m^2	41.00
7	**Half Barrier:** Supply and install Half barrier. Use 100mm x 100mm posts; chamfered tops into metal sockets cemented into ground. Post height should be 950mm from ground level. 3no. I00mm x 38mm x 1000mm bars across. Barrier to be set approx. 2m apart. All timber to be FCS certified.	each	1.00
8	**Pipe Culverts:** Supply and Install 300mm dia. Twin wall culvert pipes bedded on 100mm depth of gravel material. Compact the backfill material to 300mm minimum depth. Weathered stone built headwalls and landscape exposed pipe ends.	each	2.00
9	**Imported Materials -** Provision of working Materials. Estimates of 60 tonnes aggregates and 75 tonnes block building stone. Costs to include all logistics including sourcing, collection and helicopter transport to site of all required materials.	each	1

Construction Method Statement — Roderick Dhu Path Proposal

1. TIMINGS AND DURATIONS

The works shall take place (proposed) between August 2021 and October 2021. Exact scheduling is subject to funding and planning approval.
The project shall last for an approximate 6-week period (continuous) weather permitting.

❖ **Phasing of works:**

- Pre-contract start up site visit between Project Manager/Principle Designer and Principle Contractor.
- Organising Helicopter Lift operation (if using), stone and aggregates collection/delivery and setting out drop sites.
- Following instructions on survey sheets completing works to the standards required in 'Appendix C – Path Survey and Specification sheets'.
- The path works shall be completed from Bottom to Top.
- Final Measure and instructions for snagging; if required.

2. CONTRACTORS & PROJECT MANAGEMENT

CLIENT:
Steamship Sir Walter Scott Trust
Trossachs Pier
Loch Katrine
Callander
FK17 8HZ

CONTRACTOR:
To Be Confirmed following competitive tender process

PROJECT MANAGEMENT:
Steamship Sir Walter Scott Trust or their designated person(s)
To Be Confirmed.

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3. HOURS OF OPERATION

Work will be carried-out during any day of the week, unless specifically specified, during daylight hours only. As a guide, 0800hrs to 1800hrs. No 'lone working' will be permitted at any time.

4. ACCESS AND EGRESS

Access will be from the main visitor car park area. A compound by means of Heras fencing or similar will be cordoned off and appropriate signage will be installed to inform public and other users of the works and safety requirements.

5. COVID-19

Due to the current pandemic affecting all aspects of work and personal life and lifestyles, project management will be required to put in place requirements and safeguards to ensure works and public safety. The contractor, during the tendering process, will be required to submit a full risk assessment and statement outlining all policies and procedures required to ensure a safe working environment. All statements should consider the current conditions and best practice as set out by Government or other statutory body.

6. RISK ASSESSMENT

Risk assessments will consider the whole site, the work activities and the safety of the worker and any other persons that may come into contact with the site whilst works are being carried out. In the case of path work of this nature, this will predominantly walkers, but may also be mountain bikers or horse riders. All risks arising from hazards associated with the work that may endanger the staff or the public will be identified and assessed in advance of any work taking place. The assessment considers the severity and likelihood of accidents and injuries occurring and what action or controls should be taken to remove or reduce any significant risks to an acceptable level. This is will be recorded on a Risk Assessment Form. Risk assessments will help inform the arrangements for managing safety that are set out in the construction phase plan.

Risk assessments will be carried out at all stages of the project by designers and contractors (and principal designers and principal contractors) and should be discussed and reviewed with all parties whose safety might be affected by the risks identified within them. If significant risks are identified that have no controls in place, action must be taken to rectify the situation, prior to work starting. Risk assessments will be held by the works Project Management and available on site at all times within the Site File.

7. PUBLIC SAFETY

Following on from the Risk Assessment above, the safety of the public must be considered at all times, particularly when accessing the site, working on the path or gathering materials in the surrounding area. It is the responsibility of all staff to ensure that any possible risk to the public from the works are controlled. 'Suitable and sufficient' controls may be signing the works, cordoning off the work site and re-routing the path.
Clearly worded signs will be erected at all access points to the work site to advise the public of:

- When and where works are taking place
- Alternative route if available
- Diversions around the work site
- Hazards and procedures should walkers or mountain bikers need to walk or ride through the site.

As the route in question is designed as a circular route with only one access point, an information panel shall be placed in the car park. This will alert people to the fact that works are taking place on the route, enabling them to choose to go elsewhere if they prefer.

To manage public access when required, Banksmen shall be assigned and used to facilitate safe passage of public or visitors through the working corridor.

8. PATH CONSTRUCTION - *Rationale, Guidance and Method*

8.1 – Rationale (Tools and Equipment)

The work type involved within this proposal can be viewed upon as 'Upland Path Work' as described within the UPAG Upland Path Management manual (2016) second edition. Upland Path Work uses a variety of hand tools for manual construction techniques, often with the assistance of small mechanical equipment to move materials around or to the site. Hand build work is as robust as standard construction and may use distinctive techniques and/or variations in standard construction including:

- Braid blocking to help close down multiple path lines.
- Turf lined ditches.
- Stone water bars/cross- drains and culver pipes.
- Pitching with an informal appearance utilising natural features.
- Mixed sections with pitching and stretches of aggregate surfaced path.

These works will incorporate a mix of Block stone Pitching, Aggregate surfaced path and appropriate water management/surface protection and drainage. Refer to specification sheets for further detail.

❖ **Tools**

A variety of tools will be used; the basic hand tools required are:

Hand tools:

- Pinch-bar
- Mattock
- Spade
- Shovel
- Mash hammer
- Sledge hammer
- Rake
- Hack (hooked three-pronged fork, for moving turf)
- Rutter (very heavy, big ditching spade)
- Pick axe
- Tamper
- Buckets
- Wheelbarrows

The hand-tools and type selected for use will depend largely on the particular task being carried out, but will also vary with the individual preference of the worker. There is also a wide variety of types of mattock, spade, shovel, pinch bar, rake and hammer to choose from.

❖ Safety and Care

Hand tools will be checked daily and regularly maintained to ensure that they are safe to use, as well as prolonging their life.

- Steel edges and heads should be kept free of burrs.
- Cutting edges should be kept sharp.
- Heads should be checked to ensure that they are firmly fixed to the shaft, wedges should be undamaged and secure
- Shafts should be checked for damage, such as cracks and splits in the wood, and replaced when necessary.

Tools will be safely transported to site. When carrying tools to the work site, overloading should be avoided and tools should always be carried at the side rather than over the shoulder.

❖ **Small Mechanical Equipment**

Three types of mechanical equipment will be utilised within these works:

- Power barrows
- Manually operated winches
- Vibrating plate (whacker plate)

Before using any of the aforementioned equipment, it is essential that the operator has received training in use and safety and is familiar with the manufacturer's guidelines. Mechanical equipment should only be used after maintenance checks have been made by a competent person.

- Power Barrows

Used for gathering and moving materials, they reduce the need for manual handling and lifting of materials. These are small tracked "wheel-barrows", powered by a small four stroke engine. Running on rubber tracks they spread the load over a larger area and minimise damage to vegetation. Depending on the size and make they can carry approximately 400kgs on level ground, and 250kg on a gradient, e.g. the Honda HP400. Some models have a hand operated tipping mechanism. They can be used to carry boulders, stone, aggregate, turf and soil to and from the path, as well as equipment to the work site. Users will vary the route taken to and from the path to reduce tracking and the likelihood of environmental damage.

- Winches

Tirfor ™ Cable Winches will be used during these works. These are capable of pulling loads up to 1600kgs. The winch has a shear pin that will break if the load maximum is exceeded. The main part of the winch is the gear box, where a rope is pulled using gripping jaws and a lever mechanism. The winch is used in conjunction with a wire rope, nylon strops, shackles and anchor points. Anchor points will normally be in-

situ boulders, or bedrock, which must be larger than the stone being winched. They need to be secure, with no possibility of moving once the winch is attached and operating and combined with steel pins if necessary. They must also be a suitable shape to secure a nylon strop, to which the winch is attached. If none can be found in the location, purpose made anchor points can be set up using steel pins and chains. Anchor points must withstand the force of the winch and wire rope when the load is being moved. Once a stable anchor point has been set up it should be used for winching as many loads as possible. A separate Risk Assessment should be made available from the contractor prior to use.

- Vibrating Plate

Compaction machinery such as vibrating plates may be brought in to aid aggregate path construction. Suitable for use within the flat aggregate sections within the path, the vibrating plate will assist in gaining the correct compaction rate for the aggregate material ensuring water deflection and surface longevity. The provision and use of all compaction machinery is subject to Health and Safety Regulations.

- Safety and Care

All types of mechanical equipment have restrictions and should never be used beyond their specification. They should be serviced according to the manufacturer's instructions. Safe working procedures should be followed at all times, particularly with regard to public and worker safety.

All equipment is subject to Health and Safety Regulations and require regular maintenance with daily and weekly checks. Testing must be undertaken by a competent person at six month intervals. It is a legal requirement that the correct certificates are held. Strops, ropes and shackles used with the winch should be more than capable of withstanding the maximum weights to be lifted and marked with their safe working load. They should also be routinely tested by a competent person and checked daily for wear and damage prior to use.

- **OTHER MECHANICAL EQUIPMENT**
- Helicopters

It may be prudent to utilise helicopter operations during these works (subject to contractor). Although subject to more demanding work planning, working practice and safety management, they minimise time required, manual handling and environmental impact. Helicopters are generally contracted from specialist companies: loads lifted up to 1000kg.
Path materials throughout this site are in short supply so it will be required to import all materials to facilitate the path build. Depending on cost and client/contractor preference, helicopter operations may be required. Operational specific Risk Assessments will be made available prior to any use of helicopters and the required logistical operations.
Helicopter operations will adhere to SNH guideline 'The use of helicopters and aircraft in relation to disturbance risks to Schedule 1 & 1A raptors and wider Schedule 1 species' document and helicopter operatives will follow any further constraints as laid down following SNH consultation.

8.2 Guidance

The work site shall be split into 4 working sections:

- Section 1 – from car park to flat terrace before rockfall area. Approximately 55m of comprehensive stone block pitching solution. This will address the sensitivities of the slope where mature trees are most prevalent and will also minimise any ground disturbance through excavation thus keeping root disturbance to a minimum. The pitching should be up to 1.5m in width to accommodate expected user numbers with additional 'passing places' to provide breakout areas for passing users (Covid-19 2m distancing). Pitching will be built in adherence to UPAG guidelines and should be as user friendly as possible.
- Section 2 – from terrace to Boardwalk section. This section will be a mix of aggregate surfaced path and stone pitching to address gradient fluctuations. The aggregate surface will 'float' on a geotextile

material which will allow drainage and prevent path slippage and muddying. Additional drainage features i.e. water bars and X-drains and/or culverts will be installed to manage water run-off and reduce maintenance requirements. Again, this path should be average 1.5m in width with additional passing places.

- Section 3 – from end of section 2 to final accent, it is proposed to install a section of boardwalk; these works will be separate to the path work proposed within this construction method statement.
- Section 4 – as section 2. From boardwalk to viewpoint. A mix of aggregate and pitching to reach final destination at the Roderick Dhu viewpoint.

8.3 Method of Works

❖ **PATH DESIGN AND CONSTRUCTION**

All sections of hand built aggregate path will require imported materials to facilitate construction. Aggregates used for the path will be of 'Type 2' base material with a 'Fines' (dust) topcoat. The path will be graded and compacted to leave an even surface with a slightly raised camber to shed surface water. Path edges and side ditches will be carefully landscaped using turfs and topsoil removed during construction.

- Micro-siting: paths are designed to follow a sinuous alignment, contouring and utilising desirable natural landscape features e.g. large boulders, topographical features. Wherever possible, linear alignment will be avoided to provide a more 'natural' appearance.
- Micro-siting: scale and position of built features e.g. water bars, anchor bars, bends etc. will be sited and designed to accommodate walkers. For example, step height within pitched sections will be a maximum of 100mm and avoid large built drainage features.

➢ Sequence of Operations

i. Install compound and safety signage.
ii. Ensure site is safe to access to transport all plant /tools to start of site.
iii. Erect site signage and barriers.
iv. Lift turf from path line and place to one side.
v. Strip turf from ditch line and place to one side (where applicable).
vi. Excavate path tray and prepare suitable sub-base including fitment of Geotextile where using.
vii. Surplus turf is used to landscape path margins and line ditch where practicable.
viii. After a reasonable length of path has been prepared, imported materials are used to fill path line (by way of power-carrier or if previously imported by helicopter) and spread manually to give finished path surface.
ix. Drainage features to be installed where specified.
x. Work to progress along path.
xi. On completion of works signage to be removed and tools to be taken off site.

The sequence of operation is true for both aggregate path and block stone pitching. Only manageable sections will be worked on, to completion, before moving on. Typically, a 4-person team will work in 2 teams, overlapping sections as they complete each section providing a continuous evolution of path.

❖ **PATH MATERIALS**

It is recommended, due to the lack of useable on-site materials, that all materials intended for use within the path should be imported. Block stone should be sought from a suitable quarry; rock type to match the type found on site. Aggregate materials should be made up from Type 2 base material to a minimum depth of 150mm with a 25mm dust or fines topcoat; compacted to refusal to provide a weather resistant finish.

Turf and vegetation, whether heather or grass, shall be removed for as brief a period as possible. This shall be part of a contiguous process of removing the turfs and laying to one side, turf side up.
Substantial peat and spoil attached to the turf to protect the root mass will contribute substantially to the vegetation's recovery and survival. The process metre by metre of laying the path will ensure that any turf is not left exposed for any prolonged period of time. Nevertheless, should there be any unforeseen delay,

to help retain moisture, the turf will be covered with synthetic material or matting. Turfs will be carefully managed by type and care will be taken not to mix habitats. Turfs shall be removed and replanted as near to their original position as possible. Turf type, i.e. wet or dry, shall not be mixed or transplanted into unsuitable areas where the vegetation will die off. For example, wet, peat heavy, moss rich turf is unsuitable for transplant to a dry, free draining grassland area. Transplanted turf will aim to recreate a pattern sympathetic to the vegetation found in the location prior to the works being undertaken.

It is expected that the level of exposure to drying out is negligible, the quick re-use of the turfs in the side ditches and the edges of the path is key to their survival ensuring limited or no loss of habitat. To prevent the leading edge of the root system drying out, and vegetation dying, turfs will be fitted tightly together, with overlapping joins. This practice, learned from upland turf lined ditches, has been carried out for many years; within months of construction the turfs show signs of bedding in, and due to the low lying and damp area being developed, a single growing season should return exceptional establishment.

- **REINFORCED SURFACING: Aggregate Path on Peat/ground water protection.**
  - Floating the path

Where the 'Wetland Typology Field Survey's' identified any sections as having characteristics of wetland typology and therefore a potential impact on groundwater dependant terrestrial ecosystems (GWDTE), to mitigate against any risk to the GWDTE the path will be floated by using geotextiles. A semi-permeable membrane will be laid under the path at a depth of 300mm separating the path material from the peat; it will prevent aggregate loss and the path subsequently disappearing. This technique also reduces the amount of excavation and aggregate required compared to excavating to a hard base and infilling with stone.

The use of synthetic geotextiles to provide the foundation, and 'float' the path over deep peat, has been copied from developed from road engineering and construction methods. 'Terram' 2000 to be used on full length where gradient is <6°; 'Tensar' TS20 to be used on sections where the gradient exceeds 6°, and/or on very soft ground and on benched crossfalls. Whilst the geotextile has a material or fabric structure the Terram has an open grid structure holding the aggregate material in place, reducing the likelihood of slippage. Aggregate base and surface will be a minimum depth of 300mm. No geotextile will be left exposed above the path surface.

This measure will protect the GWDTE allowing groundwater to permeate the path and move through the peat below the path surface, allowing the continual movement of water under the path. If the peat has no structure or is very wet, the formed tray should be increased to 300mm wider than the required path width, on each side. This allows for a greater geotextile width, which will give added strength to the path base, and allow better water drainage from the path base. Good size turf sections will be required to place over the excess width of geotextile, and to create the tray edges and secure the geotextile.

<u>Matting (Geotextile)</u>

The matting, of tightly woven synthetic fibres, is the separation material used to 'float' the path. Geotextile main properties are:

- Separates the path material from underlying soils.
- Semi-permeable allowing water to seep through and drain away from the path structure.
- Spreads the load across the path width and length and prevents subsidence or sinking into soft areas.

Mattings come in several grades, the highest provide greater load bearing strength, which will be required over areas of very deep or wet peat. Lower grades are suitable where the peat layer is thin or has a higher mineral content. The one most widely used in Scotland is "Terram" 2000.

Geogrid

Geogrid is a thick plastic mesh, which is used in addition to matting where extra support is required, particularly on very soft ground. It also helps to hold the aggregate in position.

The main properties are:

- Provides a strong path foundation.
- Spreads the weight of path use over the full path length and width.
- Grid structure prevents path material from moving along, or across the matting and migrating from the path sides.

Geogrids may be used with lower grade matting for additional strength over deep wet peat area if required. Geogrid is particularly useful to prevent movement of the base aggregate where there is a cross-slope or a downhill gradient. The type predominantly used in Scotland is 'Tensar' TS20.

Geotextiles are normally supplied in rolls, of variable width and length. Whole rolls of matting may be cut, off-site, to a suitable width using a chain saw or hack saw. The lengths required can be cut on-site using a sharp knife or heavy-duty scissors.

❖ METHOD OF CONSTRUCTION

Stage 1

Form the path tray.

- Excavate the tray as for an aggregate path, with the exception that the depth does not need to reach a solid base.
- Form a base that is level and even for laying the geotextile.
- Remove any sharp or protruding items to prevent distortion or puncturing of the matting.
- If the ground/peat is very wet, or has no vegetative content, form the tray depth and revet/support sides with good size, heavy turf, with rock reinforcement if required (revetment), after laying matting.

Stage 2

Lay the geotextile matting.

- Line the path tray with the geotextile matting, cutting it to the required width allowing for up to one metre on either side of the path line.
- To take up curves and bends in the path either fold the matting or cut it to suitable lengths, allowing an overlap of at least 300mm.
- Secure folds or overlaps with larger aggregate stone to prevent them protruding up through the path material.
- If a tray is not being dug or required, a raised tray should be formed with large turf and boulders creating a reinforced edge. The matting should extend at least 1m either side to prevent migration or slippage.

Stage 3 (if required)

Lay the geogrid.

- Where required, lay the geogrid over the matting, cut to the required path width. For bends in the path alignment; as with the matting, joins should overlap by 300mm.
- Where there is an excess on either side, due to the variable path width, it should be dug into the tray edges, or, if the matting is folded up, cut to the exact size.
- The geogrid should not curve up the tray sides; it is important that no geogrid edges are left exposed after the surface has been laid and compacted.

Stage 4

Incorporate drainage features.

- Construct drainage features as for an aggregate path, with the exception that geotextile should be laid to continue into construction trenches.
- For ease of laying, and to provide additional strength, cut the geotextile to allow a full overlap across the drainage trench width.

Stage 5
Construct the aggregate path.

- Take care to prevent any puncturing of the matting when laying and compacting the lower layer of base, or sub-base material.

Stage 6
Edge finishing.

- Make sure that any turf already laid are effective in covering the geotextile and containing the aggregate. Adjust landscaping where necessary.
- The path edges may require further turfing and landscaping, to define the line and 'soften' the appearance.

9. DRAINAGE

There are no known water courses within the site boundary. Drains and culverts will not introduce water directly into burns and water courses. Any discharge will be allowed to run off and disperse naturally.

10. SEDIMENT

A key aspect to considerably reducing sediment flow for upland path drainage is the use of turf lined ditches. Unlike an open-faced ditch of bare soil increasing flow rate and sediment run-off/movement, the turf lined ditch contains the sediment, protecting the drain from flash flood and scour by a process of seepage or reducing the flow rate. As such, any drainage channels required within these works will be turf lined as a prevention method.

❖ Pollution Prevention – Dealing with Surface Run-Off During Construction

No muddy surface waters or discoloured ground water is to be admitted to burns, surface water drain or other watercourse. Any water bars, X-drains or culverts built in the vicinity of open water courses, will be constructed with Silt Traps at the discharge point to act as sumps to prevent silt from entering any close proximity water course.

11. EXCAVATIONS

No extensive excavations are planned during these works however should there be the requirement for any excavations, the following must be adhered to. Excavations must be clearly protected to prevent any persons, materials or equipment falling into them. Light weight protective portable barriers will be used to protect sites identified as a hazard after risk assessment. Barriers and signage will be checked regularly to ensure they are in place; if necessary signs will be installed again should any go missing, this procedure will continue throughout the duration of the contract. This is essential before the site is left unattended, particularly at weekends and when work is over for the day.

12. EMERGENCY EQUIPMENT

Contingency procedures are to be available for use in the event of a spillage. Spill kits, complete with absorbent material are to be provided and instruction of use known by the contractor. Any spilled material is to be contained and reported to the environmental protection authority immediately.

13. THE CONTROL OF FUEL AND LUBRICATING FLUIDS

Power carrier (power barrow) to be refuelled from a double bunded container prior to going to site. Ground spill protection shall be used in the form of Plant Nappy containment system during fuelling and any machinery while idle, shall be placed upon the containment system.

14. SITE PRECAUTIONS

All vehicles, plant (power barrows, vibrating plate etc) and equipment shall be strictly maintained and operated in accordance with authorised guidelines, instructions and directives. The site working area shall be signposted, taped off and warning notices posted to warn the public. Banksmen shall be on site during any operations and should any persons come through the site, they will be safely escorted around any active works.

15. SITE DEMOBILISATION

All equipment, plant, temporary works etc. and other traces of occupation of the site will be removed from the site within one week of the path-works finishing. All ground vegetation surface wear and tear will be repaired to its former natural state using the appropriate reinstatement technique such as spot turfing or blanket turfing. This repair work will be immediately carried out by the contractor once the site infrastructure has been vacated and to the satisfaction of the works Project Manager, The Park Authority and Landowner.

16. PROTECTED SPECIES

Prior to any works taking place, a habitat survey should be undertaken to provide information on any protected species that may be present within the works area. This survey should include but not be limited to, Bats, Otter, Badger and raptors.

Should any protected species be found whilst works are ongoing, works shall stop immediately and the works supervisor shall inform the client. SNH will be consulted on how best to proceed and notification shall also be given to the planning authority.

If there is potential for protected avian species to be present, SNH guidance on 'The use of helicopters and aircraft in relation to disturbance risks to Schedule 1 & 1A raptors and wider Schedule 1 species' will be strictly adhered to.

RSPB/Local Raptor Study Groups will be consulted regarding birds of prey for all works and mitigation. If more extensive than general raptor good practice guidance from SNH is advised, then this will be followed.

There will be clear mitigation in place to protect badgers and otters (there is a possibility that badgers could be in the surrounding area at the foot of Ben Venue).

The works sites could have, or be close to, black grouse leks. Works will start after sunrise and will not continue after sunset so there should be no disturbance of a lek. No further work is required for this species on this basis.

Toolbox Talks, in general, will cover specific issues that have been identified from walking around the site, issues raised during site briefings or those which cause the most accidents or near misses on site. The issues can include but are not exclusive to:

- Manual handling.
- Slips and trips.
- Noise induced hearing loss.
- Bad backs.
- Hand arm Vibration Syndrome.

Toolbox talks will also be made available to convey information to the contractor in the event of a protected species being discovered during vegetation clearance works. Additionally, for the contractor's awareness, toolbox talks will discuss protected species associated with the locality and the importance to mitigate against disturbance.

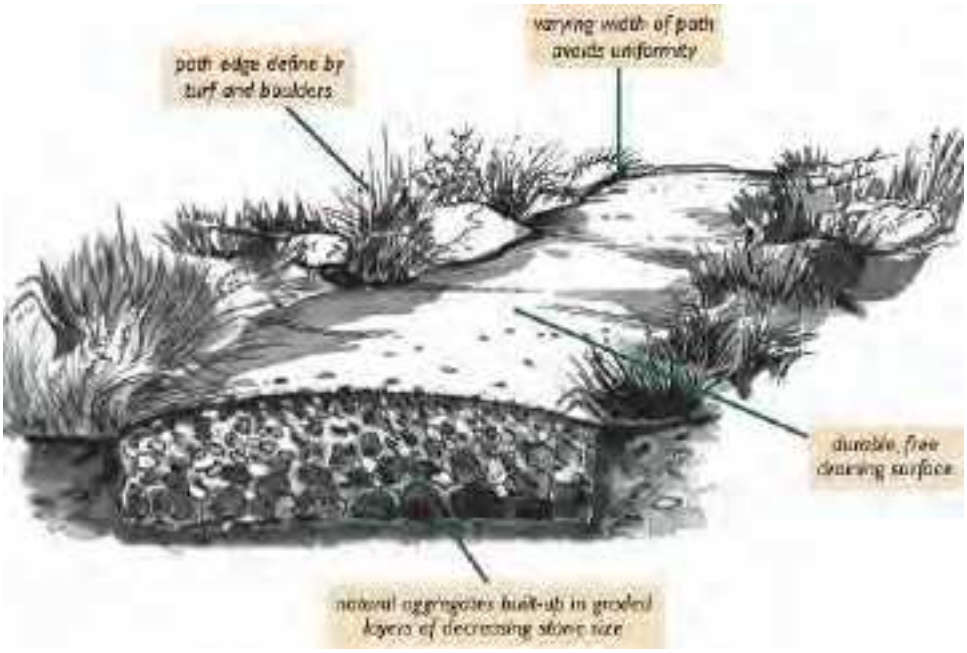
Any protected species discovered, flora or fauna, not previously identified as part of a habitat survey, will be notified to the works Project Manager who in turn will notify the Loch Lomond and Trossachs National Park Natural Heritage Planning Officer and SNH.

For flora/nesting sites if found during the works, works will stop in the localised area and the item(s) cordoned off until further advice is given from the Natural Heritage Planning Officer and SNH as to how to proceed.

Excerpt from UPAG Upland Pathwork Construction Standards for Scotland Manual 2015

Path Construction Design Specifications

Specification 1 – Raised Aggregate Path Construction (850 to 1050mm variable path width)



Function

The aggregate path provides a hard wearing, durable surface to withstand the expected pressure of use. It should be comfortable to use so that walkers will keep to it and not walk on surrounding vegetation or take alternative routes. Path edge definition with turfs and boulders, and site restoration, will help to control this. The path should be free draining, with drainage features incorporated, to withstand the expected weather and waterflow.

Use locally won aggregate to re-construct existing path to a width varying between 850 - 1050mm, and a minimum depth of 250mm. Grade base material depth to allow 50mm of graded surface material, with a binding of fine material. Compact to form draining cambers or cross-falls. Use excavated material with turves and boulders to define and contain the path edge.

DIMENSION GUIDELINES

- the width should be naturally varied along the length of construction; the average width will be determined by the path assessment - this may be as little as 850mm, or up to 1050mm;

- the average tray depth should be no less than 250mm; the path tray base should be a solid, natural mineral soil foundation; where path tray excavation reaches 300mm and the ground is still soft, or wet, geotextile will be required the depth of construction, or path tray, will depend on the nature of the ground and depth of erosion; softer ground, and heavier use will require a deeper tray and a sub base;

- the depth of surface, base and sub-base will depend on the tray depth, and material available; minimum depths should be:

    - 50mm of compacted surface material.
    - 100mm of compacted base material.
    - 150mm of sub-base material.

- the surface layer should always be at least 50mm to prevent exposure of the rougher base course through pressure of use; combined base and sub-base depths can be varied, depending on material source and stone size available (see below);

- the surface camber or crossfall should be between 2° to 5°, to effectively shed surface water;

- the finished path surface should be no lower than the ground at the path edge to avoid water collecting here.

MATERIALS

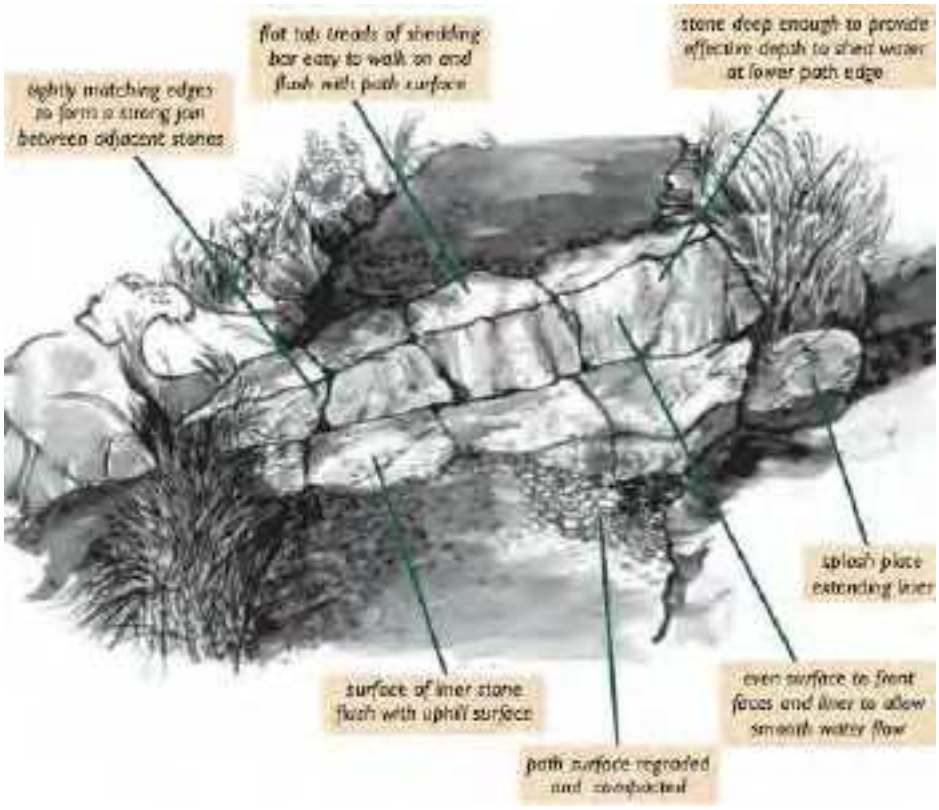
On-site aggregate will be won from the surrounding area from borrow pits. Material should not be used 'as dug' but graded for each path layer. Where feasible this may be done using purpose built screens with different size wire mesh.

The source available may dictate the grading but, as a rough guide, the largest size stone for each layer should be at least 50% of the layer depth. For minimum depths:

- sub-base stone would be between 75 - 150mm, graded down to approximately 10mm.
- base stone would be between 50 - 100mm, graded down to 5mm, with some fine particles.
- surface stone would be 25 - 50mm, graded down to fine particles.
- binding stone should always be no more than 5mm graded down to very fine particles.

Stone should be angular for good interlocking. Binding material should have a high mineral content and be free draining, i.e. with not too much peat or soil. In some places the binding layer may be clay.

Specification 2 – Stone Waterbar



Function

The key function of a waterbar is to divert running surface water off a sloping path. Without them the path surface scours and gradually becomes so rough, gullied and wet that walkers will not use it. Waterbars can also help to stabilise the path surface, by providing a solid anchor. A waterbar does a different job from crossdrains, which are generally used to take water from uphill ground, across the path.

Use local, weathered stone to construct a waterbar, between 30°- 45° to the path line. Bar depth should be a minimum 100mm rising to approximately 150mm. Liner should provide a draining fall of 5° minimum. Extend by 300mm on each path side. Include splash plate if ground drops steeply. Re-construct path at least 2 metres above and below the waterbar.

DIMENSION GUIDLINES

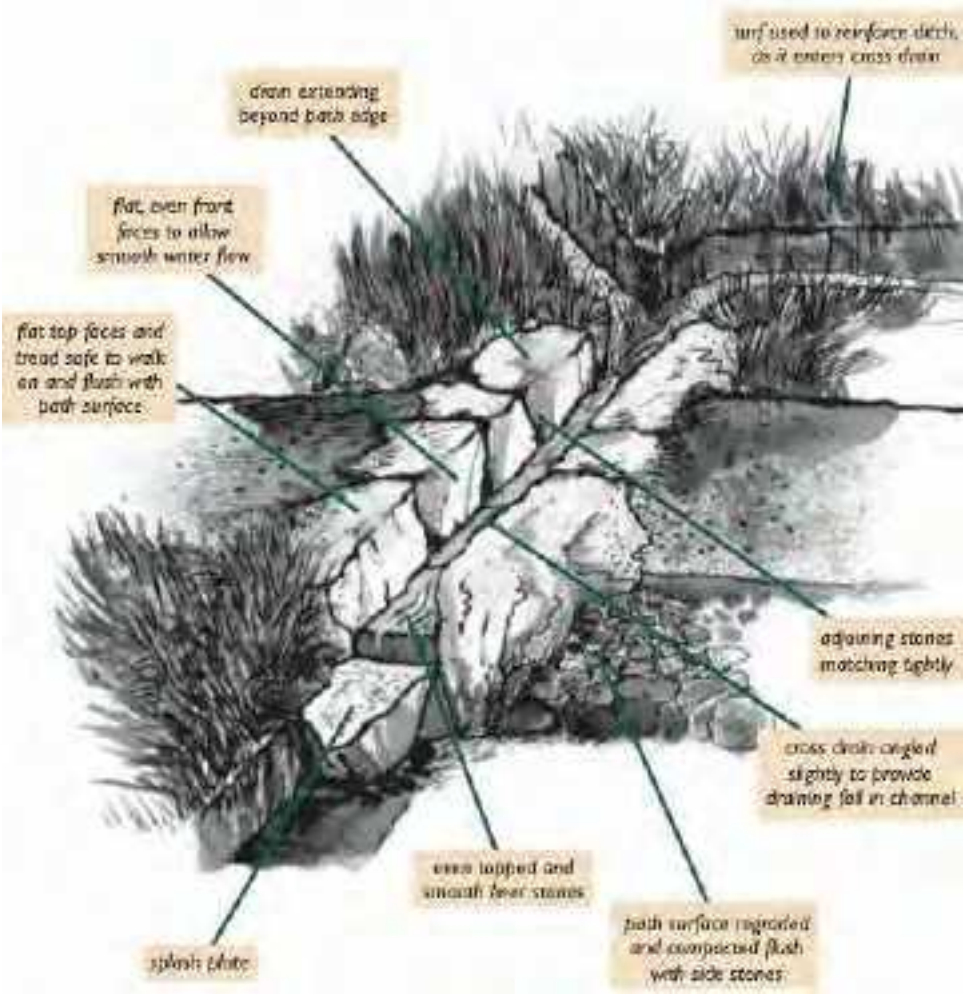
- the angle of the waterbar across the path should provide an adequate fall and be between 30°- 45° to the path;
- the draining fall in the liner across the path should be no less than 5°, and up to 15°;
- the bar upstand above the liner should effectively catch and disperse the water and be a minimum of 100mm depth at the upper path edge rising to approximately 150mm at the lower edge, but not present a barrier to path user top surface of the bar stone should be flush with the downhill surface;
- the surface of the liner stones should be flush with the uphill surface and slightly angled down to the bar stone;
- the bar should extend approximately 300mm either side of the path, as the site allows, to prevent water flowing back onto the path, and walkers from walking around and damaging the path edges.

MATERIALS

Local stone selected should be in its natural form, preferably weathered. The amount of stone needed will depend on the path width. The following points should be noted when selecting stone.

- block stone for the bar should be large enough to withstand the pressure of path use, the greatest waterflow, and frost heave - if it can be moved and lifted easily it will be too small;
- bar stones should be deep enough for half the depth to be below the liner level, and to provide the required upstand depth;
- the front face of the bar stone should have no protrusions and provide an even surface with adjacent bar stones;
- the top face, or tread, of bar stone should be large enough and suitable for walkers to step onto;
- liner stones can be smaller, but must be at least 200mm deep to prevent under-mining and movement by heavy water flow;
- the upper surface of liner stones should have no protrusions and provide an even surface with adjoining liners.

Specification 3 – Stone Cross Drain



The stone cross-drain is a traditional, and versatile, drainage feature, sometimes referred to as an open culvert, or a stone lined ditch. The elements of the design used today remain relatively unchanged from those used on stalkers paths and hill tracks.

FUNCTION

The main purpose of the cross-drain is to channel water from above the path to the lower side. The source of the water may be from small streams, springs, mossy flushes, areas of uphill surface water or seepage. Cross-drains are also used to collect and disperse path surface water at low points on the path, or on sloping paths where water bars are not suitable for the path use

Use local weathered stone to construct a stone cross-drain with a

minimum channel depth and width of 300mm. Extend by 300mm on each path side. Stone line the full length of the drain base, with a gradient of 5° minimum. Allow for an outflow splash plate and approximately 10 metres of in and out flow side ditch. Construct path at least 2 metres either side of the drain

CONSTRUCTION

The cross-drain has two main components - side walls and a lined channel base. They provide a solid channel across the path which is easy to clear of silt and debris, and is relatively self- cleansing.

- side walls provide the channel width and depth, and are comprised of two lines of block stone across the path, placed with faces to channel the water flow - essential 'stone extensions' of drainage ditch or water course sides;

- lined channel base is comprised of a row of liner stones, between the side walls, which helps to stabilise the side stones and prevents undermining by water.

A splash plate stone extending the liner stones at the outflow may be required to prevent erosion, especially where there is a steep drop, or soft ground is present.

Inflow ditches collect the water flow to be taken across the path from the water source. The ditch for the outflow may connect with the drainage system, or lower water courses, and will ensure that water is dispersed away from the path edge.

DIMENSION GUIDELINES

These will vary according to the nature, source and volume of water to be channelled, and the direction and dispersal of waterflow.

- the cross-drain is normally at a shallow angle across the path, depending on the nature and direction of flow; the angle may need to be increased in order to provide an adequate fall in the channel;

- the draining fall in the channel should be no less than 5°, and up to 10°, to ensure a clear run;

- the channel width and depth can be variable, but will normally be a minimum of 300mm deep and 300mm wide; this will allow room for a spade during maintenance, and less chance of being choked with larger debris;

- the channel should not be so wide as to provide an obstacle to path users;

- the top surface of the side stones should be flush with the path surface, to allow

collection of path surface water, and to provide a tread surface for walkers stepping across the channel;

- The Cross-drain should extend approximately 300mm either side of the path, as the site allows, to protect path edges and prevent water flowing onto the path.

MATERIALS

Large block stone is required, preferably available, from within reach of the path. It should be large enough to withstand the pressure of path use, the greatest waterflow, and frost heave. If it can be moved and lifted easily by one person it is probably too small.

It should be used in its natural form, preferably weathered (see Section 2.0), although it may be necessary to shape the stone slightly by chipping off minor protrusions. The quantity of stone required will depend on the size of cross-drain to be built and the path width.

Points to note when selecting stone.

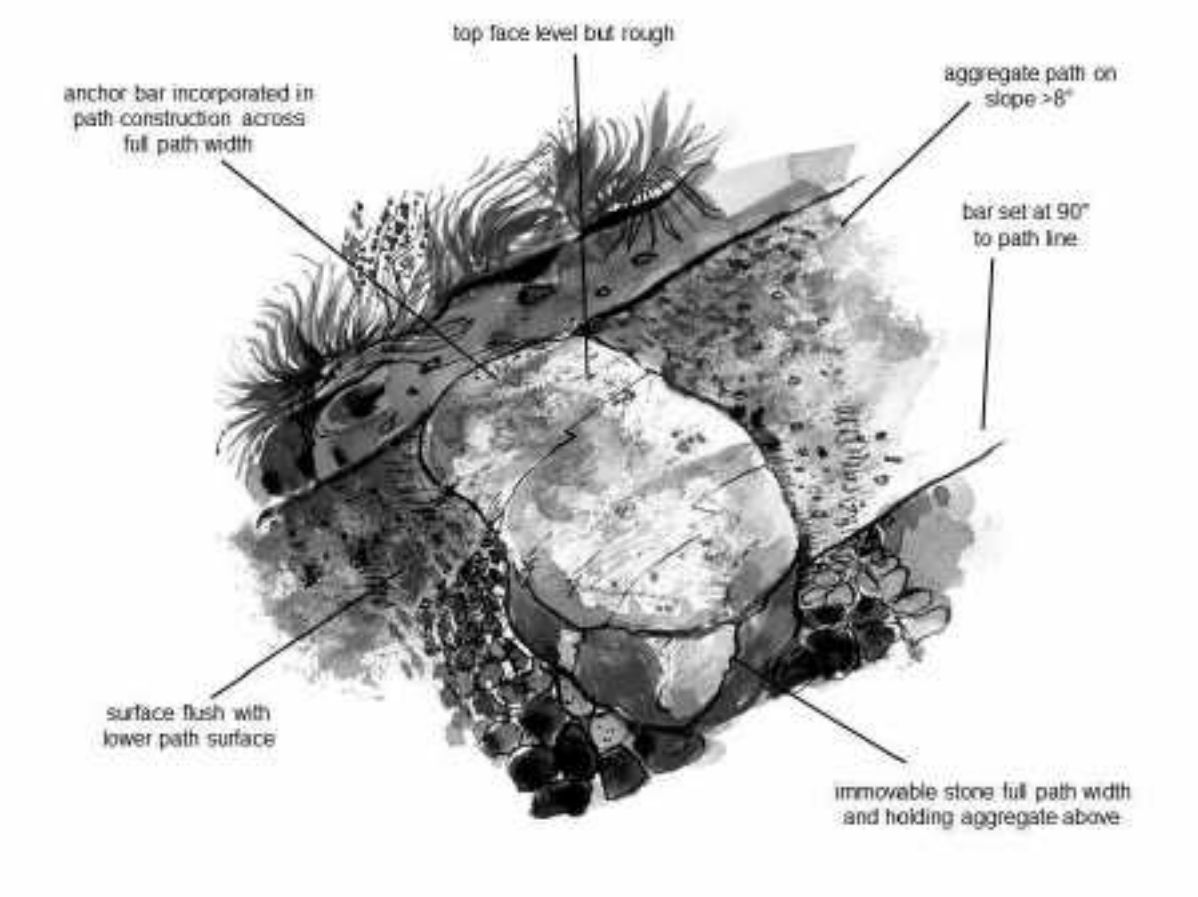
- side, or face stones should be deep enough for at least 1/3 to be below the surface of the liner, and to provide the required channel depth above the liner;
- faces forming the channel side should be as even as possible, with no protrusions that may hamper water flow or collect debris;
- tread faces should be as even as possible, with no protrusions for walkers to trip on;
- the shape should match evenly and tightly with the adjacent side stones;
- liner stones can be smaller, but must be wide enough for the required channel width, and at least 1/3 of the depth of the side stones; also large enough to prevent undermining by fast and high volumes of water;
- upper surfaces should provide an even channel surface with adjoining liners, and have no protrusions to hamper water flow and collect debris.

Specification 4 - Anchor Bars: Aggregate Paths on Slopes

Where an aggregate path is constructed on a slope greater than 8° (15%), there is the risk of the material migrating down the slope, particularly if the binding properties are not good, or there is a high level of path use. To help prevent this occurring stone anchor bars can be incorporated into the path structure. However, not all paths on gradients require anchor bars. They may not be necessary if the surface and base material binds well, or if the path is well protected by drainage features, and the level of use is low.

A range of options should be considered for paths on gradients including ensuring that there are plenty of waterbars and using short sections of pitching. The selection of

techniques needs to be based on a judgement of how the path will be used and maintained bearing in mind that long flights of pitching at relatively low gradients do not get used and that aggregate is not stable on steeper slopes. There is also a need to consider the potential for mountain bikes bouncing on the aggregate off the anchor step and actually speeding up deterioration.



Function

Anchor bars form solid, immovable structures within the path construction and, depending on their spacing, hold the aggregate on the slope above. The anchor bar may be used with water bar construction, as the stabilising stone below the shedding bar stones. Anchor bars can be added to existing paths that are showing signs of movement.

Bill of Quantities (example)

Re-construct existing path with aggregate to a variable width, between 600-1000mm. Use large block stone to construct anchor bars every 10m, across the full path width, and flush with the path surface on the upper edge.

Positioning of Anchor Bars

Anchor bars will generally be used on paths with a gradient between 8° to 16° (15-30%), but if the surface material does not bind well anchor bars can be useful on slopes as low as 5° (10%). On mobile slopes extra effort should be made to improve the binding

properties of surfacing and to compact firmly, as well as carefully, considering the spacing of anchor bars. Depending on the gradient and surface material anchor bars should be positioned at intervals of between 3 and 20 metres.

The following table gives a general guide to spacing.

Gradient of Path			
Gradient	low 8-10°	medium 10-12°	high 12-16°
Spacing	10-15m	5-10m	3-5m

Construction

Components

The anchor bar is an informal structure, comprising one or two large block stones, set across the path line. The block stone is sunk into the path with the top face just visible as a part of the path surface and should not normally stick up like a step. Depending on the gradient and the size of stone available it may be necessary to have a double row, or two courses, of stone.

Dimension Guidelines

- the bar should span the full width of the path line; this may require the use of more than one stone;
- the bar should be positioned at approximately 90° to the path line;
- stone should be set in approximately 200mm deeper than the path construction depth, so that the bar is an immovable, "independent" structure, which will withstand the weight of aggregate and the pressure of use;
- the top surface, or tread, of the stone should be flush with the path surface; the lower edge should not normally form a step up from the surface below;
- on steeper paths it may be necessary to have a slight step, to avoid the tread being at an uncomfortable angle to walk on;
- a double course of stone may be used to provide the height gain required without creating too high and unnatural a step.

Materials

The local stone selected should be in its natural form, preferably weathered.

- the stone should be large enough to hold the compacted aggregate above and the pressure of path use - if it can be moved and lifted easily it will be too small;
- the stone should be at least the width of the constructed path, if two stones are used each should be at least half the path width; it is better for stone to extend outside the path edges than be too narrow;
- the stone should be deep enough to bury into the ground by approximately 200mm below the path base;
- it should have a level, but rough top face for the tread; it should have no large protrusions, but not be so smooth that people will slip with gravel on the surface.

Method of Construction

Anchor bars are built into the excavated path tray before the aggregate is laid.

Step 1

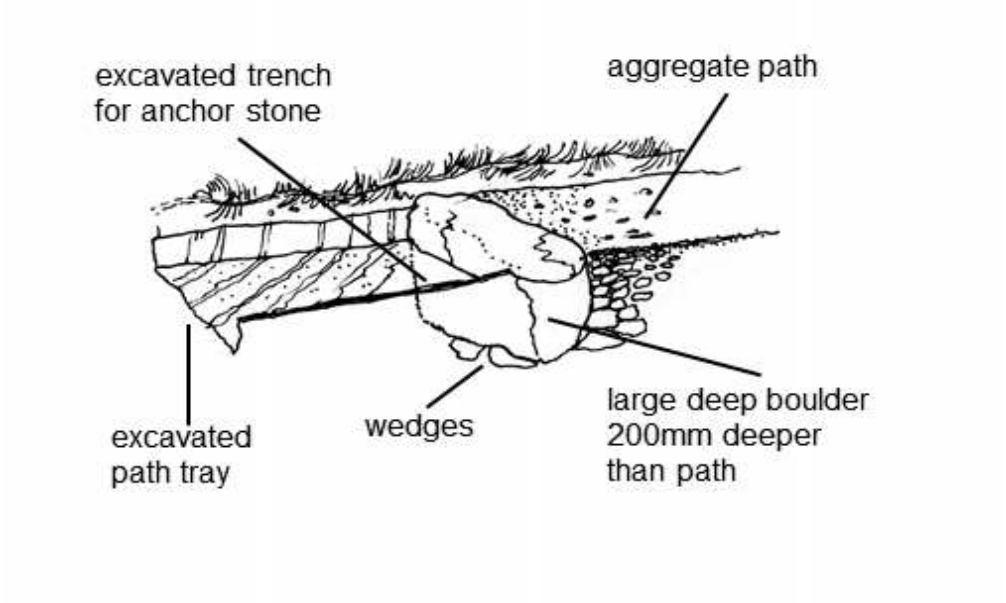
Excavate a trench

- dig a trench approximately 200mm deep across the full width of the path tray;
- the trench should be wide enough to allow for the width of the bar stone and the depth required for bar stone tread to be flush with the path surface.

Step 2

Position the anchor bar stone or stones

- set the anchor bar stone so that the surface will be flush with the compacted path surface, and not create a step, unless the path is steep;
- if a second stone is necessary they should be tightly butted together to form a solid bar across the path and provide an even tread surface;
- wedge and pack any gaps with smaller stone, and backfill the trench firmly, to form an immovable structure.



Step 3

Construct the aggregate path.

- take care not to dislodge the anchor bar when compacting the path material above and below the bar;
- make sure that the surface layer is compacted to be flush with the top and bottom edges of the bar stone or stones.

Troubleshooting

Key points to watch out for:

- use large stone, if possible one to span the full path width - too small a stone will become loose with the weight and pressure of the path;
- keep the bar flush with the uphill path surface - avoid steps up from the downhill surface;
- avoid using anchor bars on too steep and mobile a gradient – short sections of pitching and aggregate may be a better solution.

Variations

If large block stone is not available the anchor bar may be formed by constructing short sections of pitching. This will also be suitable on steeper gradients where double rows of large block stone, or longer sections of pitching, may be required to "take up" the gradient without creating high and formal steps.

An anchor bar can be built 2 or 3m down a path from a water feature, such as a waterbar. The anchor bar will hold the surfacing on the ramp below the waterbar, creating a more durable walking surface and preventing erosion behind the face stones.

A further variation on steeper slopes is to build anchor bars with a step. This reduces the gradient of the aggregate between the anchor bars, but will require more maintenance and is likely to be less successful on very mobile slopes.

Maintenance Tasks

Anchor bars require maintenance on a regular basis:

- check the stability of the stonework - re-pack where there is movement or any visible gaps;
- re-pack aggregate surfacing above and below the bar where compaction or erosion may have taken place;
- if anchor bars are not preventing downhill movement of aggregate, some re-alignment of the path may be required using short sections of pitching and aggregate.

Often anchor bars are added to an existing aggregate path on a slope, at time of maintenance, to solve problems of surface movement.

ENVIRONMENTAL SENSITIVITIES

Use natural looking weathered stone, that will blend in with the surrounding landscape turf over the edges of the anchor bar where they extend outside the path edge.

HEALTH AND SAFETY HAZARDS

Use safe lifting techniques when moving or positioning stone for the anchor bar.

TAKE CARE

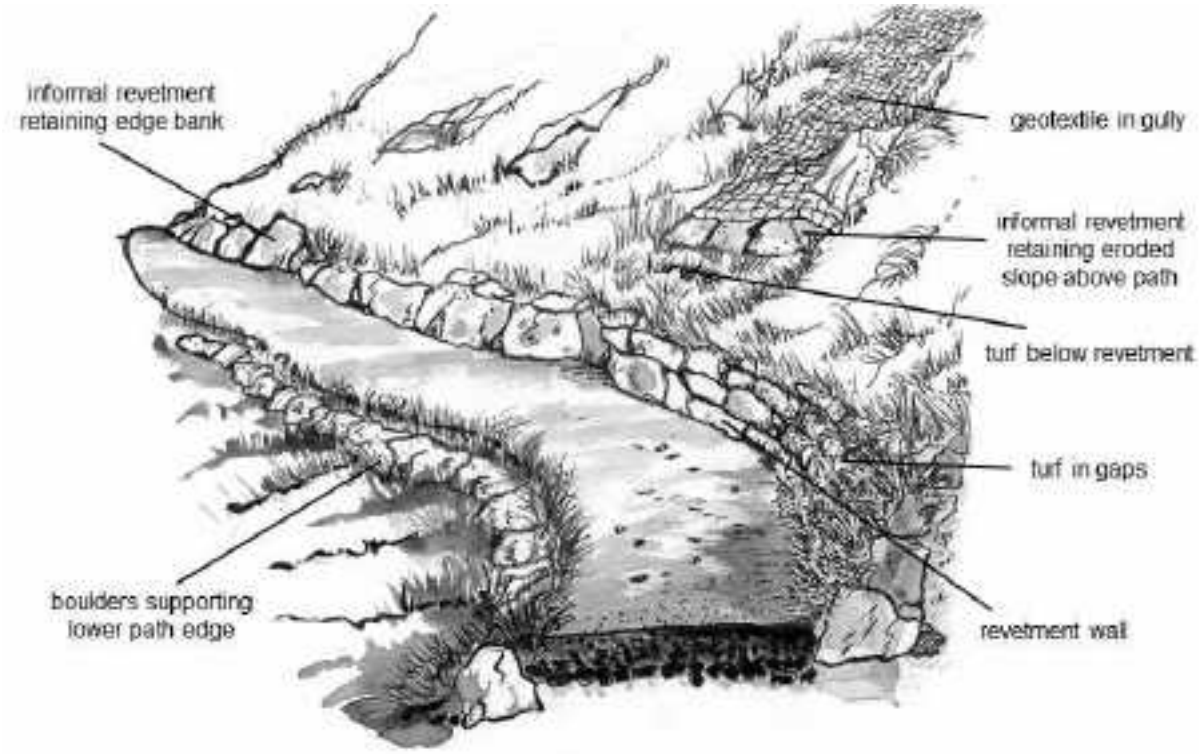
The path's dynamics must be carefully considered before deciding to use anchor bars to

stabilise it, in particular consider the gradient of the path, the mobility of path material, and the levels of use particularly on well used steeper paths where the surfacing does not bind well, migration material is likely to create 'steps' below anchor bars as the surfacing migrates downhill.

This encourages people to leave the path to avoid the step, creating braids and can increase the chances of erosion by bikes dropping off the step help avoid braiding by ensuring that anchor bars extend past the edges of the path or use blockers/vegetation mounds.

Specification 5 - Bank and Slope Stabilisation

Upland slopes are prone to slippage, particularly when vegetation has been lost. Initial loss and erosion may be caused by pressure of use, but fragile vegetation, thin friable and mobile soils, high rainfall, and frequent freeze thaw action all contribute. Slopes will need stabilising if a path solution is to be effective.



Function

The revetment wall is solidly built to retain loose or unstable ground on steep slopes. The stabilised slope will then provide a better base for revegetation. Revetments are also used to support and consolidate banks along path edges. The most typical situations for its use are:

- on open eroded slopes, or gullies associated with the old path alignment;
- where the path traverses a slope, either on one line or zigzagging;
- to support a lower path edge from collapsing down the slope;
- to retain the bank or slope above from collapsing onto the path, either at the path

edge or on the slope above.

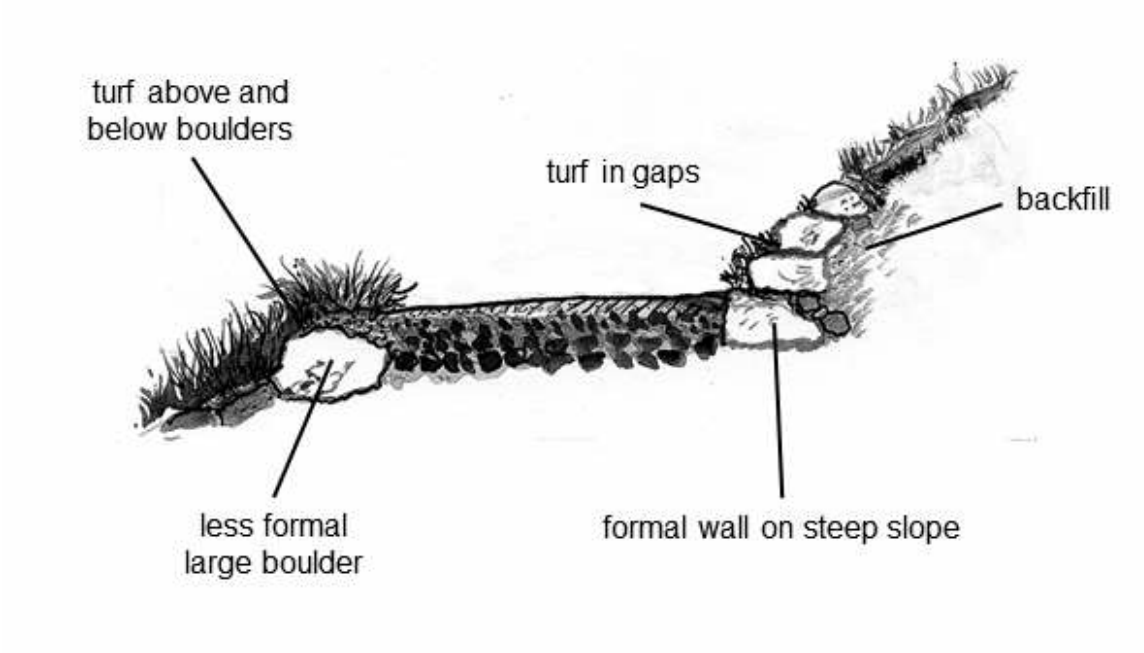
Bill of Quantities (example)

Using natural weathered stone construct an informal revetment wall to retain the slope above the path. The construction must be solid and stable, with large foundation stones, off-set joins, pinned and backfilled firmly. Pack gaps between the courses with turf, and turf over the top to blend with the upper slope.

Where revegetation over an eroded slope is necessary the revetment may be combined with turf banks and transplants, or geotextile with seed (see Restoring Vegetation).

Construction

The revetment is a rough-faced, random coursed, drystone wall. On steep slopes the structure may need to be a formal retaining wall, of approximately 500mm height, or more. Preferably, a less formal approach should be used, with large boulders butted together along the path edge to support the banking. Both should be made to look as natural as possible by incorporating turfs into and over the structure.



Materials

Revetments are built from the following:

- large boulders for informal revetments;
- variable sized, block stone for formal revetment walls;
- spoil for back-filling;
- turf for landscaping the revetment.

These are described in detail in Materials and Use. Stone for revetments should be in its natural form with the outer faces weathered, preferably lichen or moss covered, to blend

with the surroundings

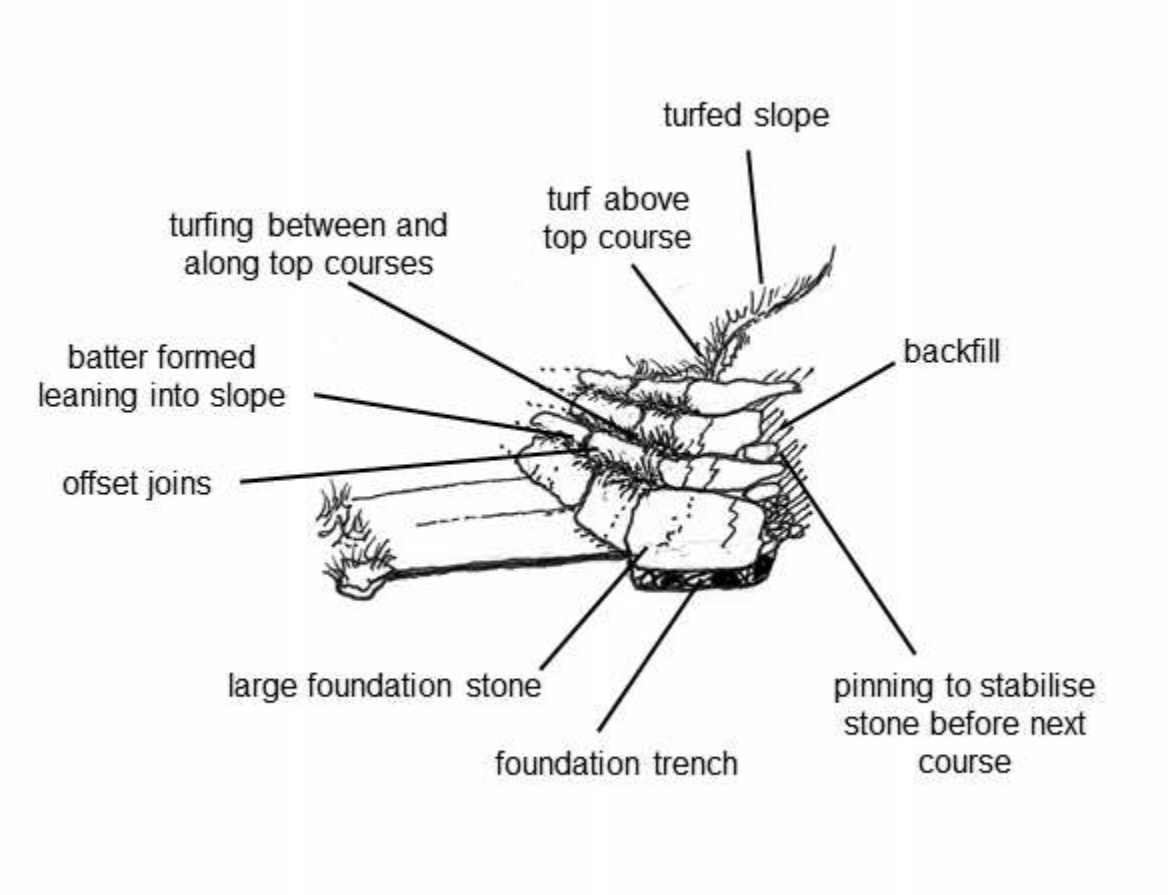
Method of construction

Foundation

The key to a solid revetment is the foundation. Whether it is the more formally constructed wall or the random boulder edge, a solid base should be excavated and levelled to build on. This should be to at least one third of the depth of the base stone.

Courses

- use the largest stones for the wall base stones, progressing with courses reducing in size towards the top; the final course should use stone that is large enough to form a solid top to the wall;
- the courses should form a batter, leaning into the slope, to provide more resistance to any slumping of the slope behind;
- outer stone faces should not protrude, as these may be used as steps, by people or animals, to climb over the wall, which will ultimately result in weakening of the structure.



- lay the stone a course at a time, butting adjoining stones tightly, and with off-set joints, to provide a solid structure;
- pin each course from behind with smaller stone wedges, to ensure that no movement occurs, before the next stone is laid;
- backfill any space behind the revetment as each course is laid; it is essential that this is packed tightly to minimise movement and settling of the soil which inevitably happens

after construction is complete.

Finishing

- fill gaps between courses on the face of the wall with turf off-cuts to help create a natural appearance;
- revetment above the path should be topped off with turf, and landscaped into the upper slope;
- to keep walkers off the top of revetments below the path edge, spoil and turf should also be used on the path edge;
- revetments supporting the lower path edge should have spoil and turf in front of the foundation stones, to help stabilise and blend them with the lower slope;
- revetments on open slopes should have turf and spoil above and below to blend into the slope and aid stabilization.

Troubleshooting

Key points to watch:

- always build on top of securely wedged stone - if the course below is loose then all those above will be unstable
- extend the revetment by one metre past the end of the bank that requires stabilising, to prevent banks collapsing around the ends

Maintenance Tasks

The following maintenance task should be carried out regularly:

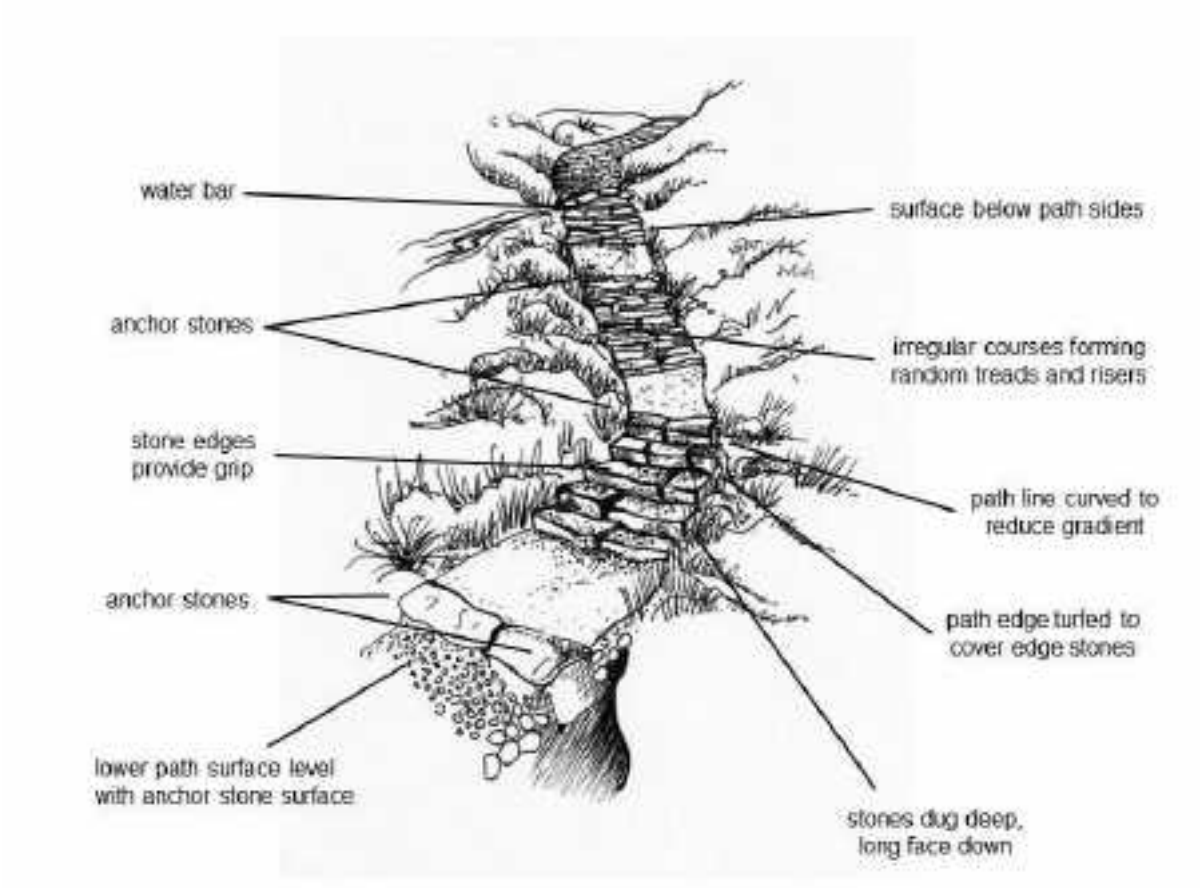
- re-packing of loose stone work with turf or stone wedges;
- re-turfing of any areas where turf has died or been damaged.

Specification 6 - Stone Pitching

Introduction

Stone pitching evolved from the smooth cobbled surface of ancient tracks and roads, into the traditional rougher cobbling of stalkers paths, suitable in the upland environment. Further adaptation developed the technique for recreational use, and to merge with the landscape.

It has gone through many years of experimentation, such as using larger boulders placed with a horizontal surface rather than angled down the slope, and this is ongoing. Stone pitching should only be used where there is no viable alternative because it is uncomfortable to walk on, particularly in descent. On steep slopes efforts should be made to align the path so that only small sections of pitching are required interspersed with an aggregate path.



Stone pitching provides a hard-wearing surface for steeper paths. It is used where aggregate is impractical or has failed due to the gradient and erosive pressure of feet and water. The pitched surface can withstand these pressures, and, with sensitive construction can blend aesthetically with the surrounding landscape.

The best sites for pitched paths are where they 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.

A pitched path is not always easy to use. It does not absorb impact, and may be steep and rough. If the surrounding ground is easier, or more comfortable to walk or ride on users will cause further erosion by short-cutting or walking on landscaped edges. An alternative of short vegetation will invariably be used if it is available.

A comfortable walking surface is therefore essential for both ascent and descent, in all conditions, 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. To encourage success of the work path lines should minimise the amount of pitching required. This may require altering the path line and managing zigzags to reduce the gradient.

Pitching may act as a hazard to bikes or be treated as a 'thrill feature' if poorly executed or badly placed – low gradient pitching should therefore be avoided.

Bill of Quantities (example)

Use local, weathered stone to construct a pitched path, average 1.2m wide. Irregular, random treads must be comfortable to use, with risers of no more than 150mm. The construction must be solid with stones fitting tightly, well packed, with overlapping joins. Use excavated turfs, spoil and boulders to define and contain the path edge.

Construction

After choosing an alignment that fits the landscape and requires the minimum amount of pitching, the main considerations are:

- provide a good surface for users, particularly on descent; allowing walkers to place a whole foot on a single tread wherever possible;
- reduce the gradient with angled lines across the slope and intersperse with aggregate path wherever possible;
- 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;
- avoid having an excessively large drop-off which can cause bikes to 'ground' the chain ring on the descent;
- 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;
- pitching changes the rhythm of walkers' strides and a few lower steps to lead into it helps to encourage use, rather than an abrupt big first step;
- landscape carefully to further encourage walkers to stay on the path.

Components

Stone pitching comprises various stone shapes and sizes, used in rough courses across the slope, to provide a series of irregular and random low steps and footholds, with a cobbled

or bouldery appearance.

The largest block stones are used as anchor stones at the bottom of pitched lengths, and at regular intervals throughout the length to support the stonework above. Large stones are also used at the path edge for structural stability.

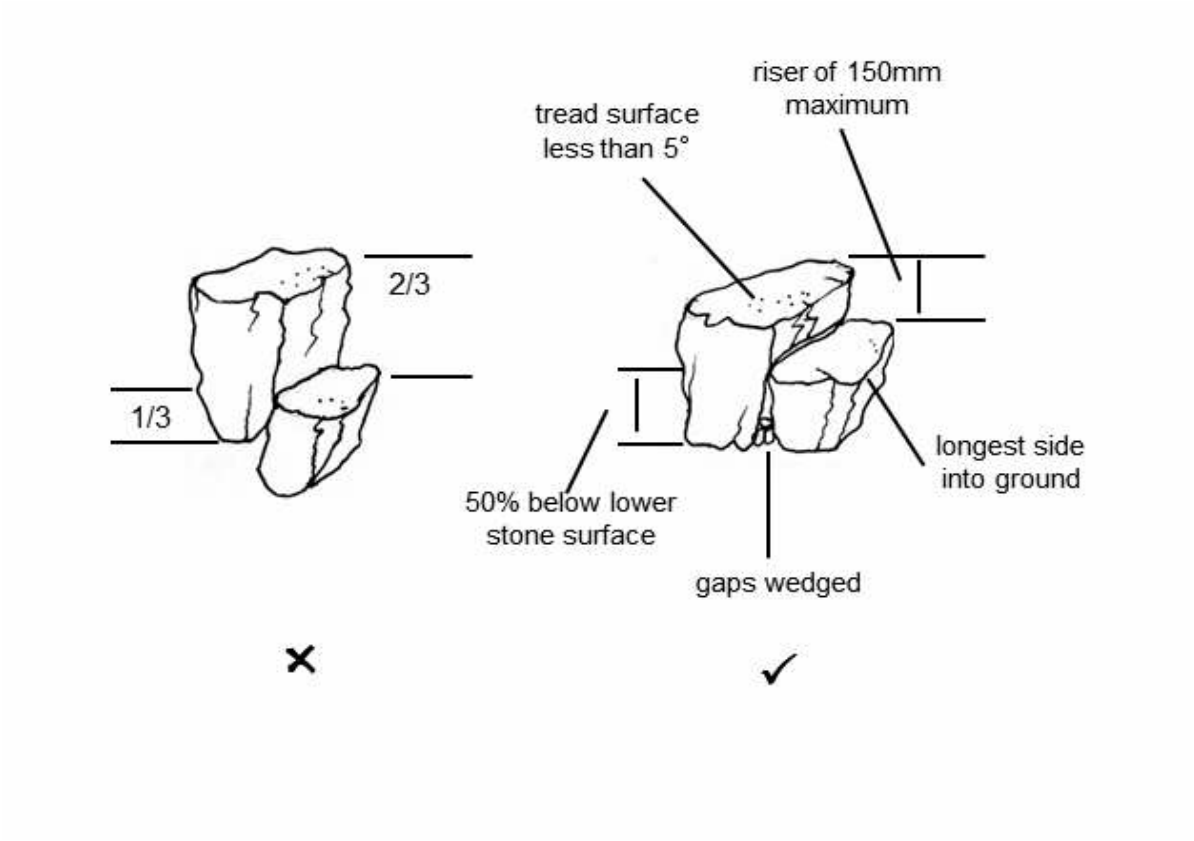
Drainage features are incorporated at regular intervals. For path surface water these will be water bars, although cross drains can also be used. It is good practice to protect the path surface below the pitching with a drain close to the bottom. The top of the pitched length should be similarly protected, but this does not need to be directly at the top of the 'flight'.

The path edges are contained, defined, and softened with turf, spoil and boulders (see Restoration Techniques).

Dimension guidelines

There are varying styles of pitching, attributed predominantly to the stone type available. The basic principles for construction remain the same.

- the overall path gradient should be kept as constant as possible by incorporating curves on short steep sections, and adjusting the pitched depth and surface level;
- the path surface should be flush with the adjacent ground, with the vegetation or turf higher than the pitching. It may be necessary to raise the path edge by turfing and landscaping. Higher turf edges help the path to blend in fit better in the landscape as well as encouraging users to stay on the path;
- anchor stones at the start of pitched lengths should have the tread flush with the lower path surface; if a step down is created, the surface below will erode, the step will become too high, and the anchor stones will be under-mined; this will cause the pitching above to fail;
- pitching must not start anywhere other than at a change of gradient. If the path below the bottom anchor bar is too steep, then it will quickly erode away creating a step;
- path stone should be pitched with at least half the stone depth below the surface of the lower stone, and the longest side into the ground; the deeper the pitched depth the more solid the construction;
- the resulting upstand, or riser should ideally be no more than 150mm; if it exceeds 200mm it can be difficult to use.



- adjoining stones should form a rough course across the path with variable upstands to avoid a formal step appearance;
- stone should be pitched vertically, with the tread surface more or less horizontal; downhill tread angles should not exceed 5°;
- it is important that the overall surface is not a sloping ramp without good footholds.

Materials

The local stone selected should be in its natural form, and preferably weathered (see Environmental Impact). The quantity of stone required for pitching is high - approximately 1 tonne for $2m^2$, depending on the density and depth. If not enough is available in the vicinity of the path it may be necessary to import material to site by helicopter.

To avoid uniform steps a variety of irregular and random stone size should be selected. Stone varies considerably from thin slatey schists, and large rounded granite, to chunky sandstone blocks. Depending on what is available the following points should be noted:

- each stone should be deep enough to provide the pitched depth required - a general guide is no less than 300mm; anchor and edge stones will be deeper;
- tread faces should provide a "grippy" surface; not so rough that protrusions may be tripped over, nor smooth and slippery.

The best sources for stone are glacial surface deposits, scree slopes or rock falls on the surrounding open hill. Stream beds are another source but tend to provide rounded smooth stone which has to be used with skill.

Method of Construction

Step 1

Form a path tray

- excavate a path tray along the selected path alignment, to the required variable width;
- the depth of the tray should allow for the depth of the stone available, and for a finished path level below the surrounding vegetation;
- where the path line is severely eroded, to a variable width and depth, it may require realignment, infilling or narrowing, without any excavation; this can be achieved with careful use of spoil, turf and boulders.

Step 2

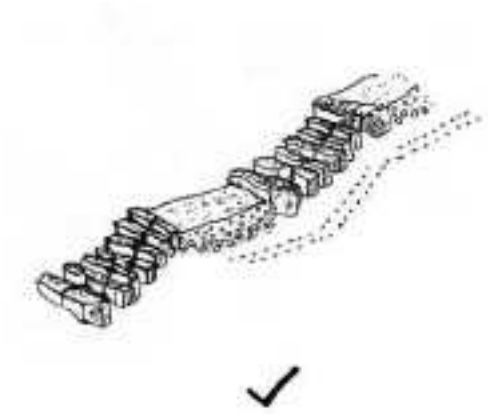
Set the pitched stone

Depending on the number of workers and the length of the path, pitching may be split into sections. If these are pitched simultaneously pay close attention to the overall gradient. To ensure that the path climbs at a steady rate, and avoid joining either too low or high, the next set of anchor stones should be visible to judge the height gain required.

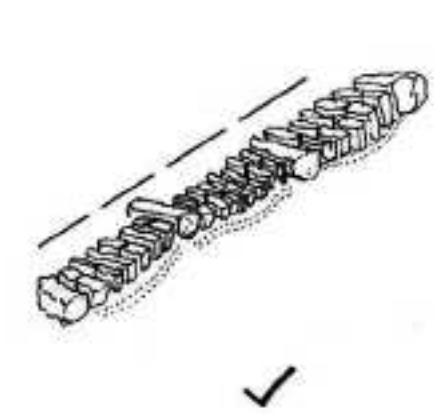
Always start at the bottom of a section and work uphill.

- the first line of stone will be large anchor stones set flush with the lower path surface; it is essential that they are dug in deep and are immovable; they may also form the lower side wall for a cross drain at the base of the pitched length;
- progressing up the slope pitch the stone into the tray in rough courses across the slope, to achieve the required random footholds and risers;
- use large, deep stone at the path edges to form a strong edge;
- butt adjoining stones tightly together, on all side faces, maintaining good footholds;
- wedge all gaps firmly, before subsequent courses are pitched, so that all path stones are solid and immovable;
- overlap joins on adjoining courses for a sound structure;
- pack remaining gaps with smaller stone and gravel; this is essential to prevent the ingress of water under the pitching, which may cause loosening and wash out, or break up with water freeze and expansion in winter;
- incorporate waterbars or cross drains at intervals required, with the bar, or side wall, stones tied in with path stone to maintain footholds.

Uneven gradient



Even gradient over changing terrain



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 corners;
- use excess turf and spoil to re-instate eroded or damaged ground (see Introduction to Restoration Techniques).

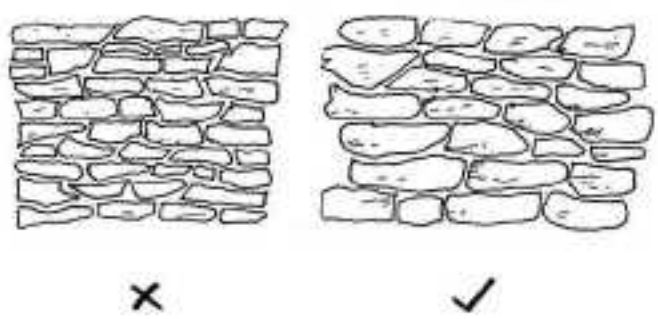
Troubleshooting

Key points to watch:

- firmly pack all stonework - this is time consuming but if neglected or not done thoroughly it will result in water damage and stonework collapse;
- make sure joins overlap for a solid, stable structure;
- provide secure footing - a rough uncomfortable surface will not be used;
- avoid regular courses of stone that create a formal step;
- match the pitching gradient to the path alignment - avoid steep sections by re-aligning and incorporating curves;
- ensure that the bottom step is flush, or nearly flush with the path leading up to it, ideally the first stone should have a big, deep tread to lead walkers on to the pitching;

Edges too straight and too many ***small stones***

Better edge - bigger stone



Variations

Stone pitched paths throughout Scotland reflect regional variations, the main influence being the geology.

The type and size of stone results in styles such as:

- Granite (boulder pitching)- large rounded stone - pitching with treads bigger than the average foot size and larger rises;
- Schist - thin slate like stone - pitching with small treads of several stones, but dug in deep;
- Sandstone - smaller blocky stone - pitching using several stone courses to form a "grippy" foothold.

The incorporation of grass seed or small strips of turf, in the packing between stones is suitable on some sites. The vegetation softens the visual impact of the hard pitched path. It can also help to stabilise pitching that may be susceptible to loosening.

Maintenance Tasks

Stone-pitching should require minimal maintenance, other than drainage features and edge work. The main tasks are:

- pack and re-set stonework where there is any movement or visible gaps;
- turf the edges where trampling and erosion has occurred;
- block any shortcuts that develop.

- **ENVIRONMENTAL SENSITIVITIES**
  - take care to avoid creating trample lines when collecting large quantities of stone from within reach of the path - vary the route to spread the pressure
  - carefully turf over scars left from removed stone, particularly if within sight of the path
  - dispose of excess stone sensitively, or use to create landscaped mounds or to in-fill borrow pits

- **HEALTH AND SAFETY HAZARDS**
  - take care to prevent stone falling onto path users or anyone working below when off-loading collected stone, or moving it from a stockpile
  - the work site is often steep, rough and restricted for space - provide alternative routes for the public whenever possible

- **TAKE CARE**
  - stone pitching should only be used where there is no alternative available - it is notoriously uncomfortable to walk on for descending walkers
  - incorporate path drainage - surface water, or ice, can make the surface very slippery, assess the site for alternative routes or better alignment
  - if the pitching is lower than the surrounding vegetation, water and snow, will collect on the path. Conversely, pitching which is high and proud does not blend in so well and is more likely to be avoided by walkers

A Functional Wetland Typology for Scotland - Field Survey Form

Date and Time	15th September 2020 09:00hrs
Surveyor Name	Gordon Paxton-White - A.C.T Heritage Ltd
Location	General description: Roderick Dhu path to viewpoint, Loch Katrine Visitor Centre National grid reference: OS GR NN 4954 0717
Weather	Current weather: Rain Preceding weather: Mild / Showers

Photos	Photo Number	Description
	1	Spring forming from below tree root plate.
	2	Soft wet grasses/mosses with surface breakage
	3	Mineral soils showing through on slope
	4	Mosses and grass indicative of area on whole
	Continue on separate sheet if necessary	

Landscape setting: refer to guidance manual for further detail						
	1a Coastal: Sand dunes		3b Waterside: Isolated floodplain		5 Valley bottom/ basin	
	1b Coastal: Intertidal or near-tidal		3c Waterside: Stream-side	X	6 Peatland	
	2 Coastal plain		3d Waterside: Loch-side		7a Cliff ledges and boulder/scree fields	
	3a Waterside: Floodplain		4 Slope	X	7b Other montane	
	If the landscape setting does not fit with the above, or more detail is required, add information here:					

Hydrological features						
	Coast		Pond		Spring	X
	Sea loch		River		Standing water/ puddles	
	Freshwater loch		Stream			
	If there are other features, or more detail is required, add information here:					

Soil indicators						
	Peat	X	Peat hags		Tufa	
	Mineral soil (e.g. sand, clay, loam)	X	Peat gullies		Machair sands	
	Bare rock	X	Sand dunes			
	If the soil type does not fit with the above, or you can also describe the geology, add information here:					

Vegetation indicators						
	Willow		Birch	X	Scots Pine	X
	Alder		Rushes		Small sedges	
	Broad-leaved sedges		Tussock sedge		Reeds	
	Carpet-forming mosses	X	Heather	X	Cottongrass	
	Other (specify):					
	Height of vegetation (excluding trees): Ankle height [X] Knee height ☐ Waist height ☐ Head height ☐ Above head height ☐					

Existing pressures: refer to guidance manual for more detail						
	Impoundment		Flood defences		Drainage	
	Nutrient enrichment		Over-grazing		Poaching of ground	
	Cutting of vegetation		Lack of management		Peat cutting	
	Invasive non-native species					
	Other, or more detail: NONE					

SNIFFER (2009) WFD95: A Functional Wetland Typology for Scotland - Field Survey Form. Version 1. ISBN 978-1-906934-24-8.
Published by SNIFFER, 25 Greenside Place, Edinburgh, Scotland, EH1 3AA. www.sniffer.org.uk Company No: SC149513 Scottish Charity: SCO22375

Sketch	On a separate sheet of paper, sketch the wetland and surrounding area. The sketch should include: - The surrounding landscape and topography - Any hydrological features - Locations and extents of different habitat types within the wetland - An indication of scale and orientation of the sketch (usually north points to the top of the page)

Habitat type identification:
In the box below, record decisions about the wetland type. If there is more than one habitat type within the wetland, record all types and mark on the sketch map their extents. Note which are the most dominant types in the comments box below.

Wetland type		**Select if present (√)**	**Photo number or sketch**	**Comments, including brief description of location and extent**
1a	Bog woodland			
1b	Other wet woodland	**X**	**All photos indicative**	**Wet woodland close to Loch on lower slope of Ben Venue. Predominant Birch and mosses with bracken, heather and sedges. Some Scots Pine present on upper sections.**
2a	Marshy grassland			
2b	Montane grassland			
3a	Montane flushes			
3b	Tufa-forming springs			
3c	Other springs			
3d	Seepages/ flushes			
4	Fen			
5	Swamp			
6	Reedbed			
7	Wet heath			
8a	Peat bog			
8b	Quaking bog			
9	Saltmarsh			
10	Dune slacks			
11	Machair			

State dominant wetland type(s), and add any other comments:

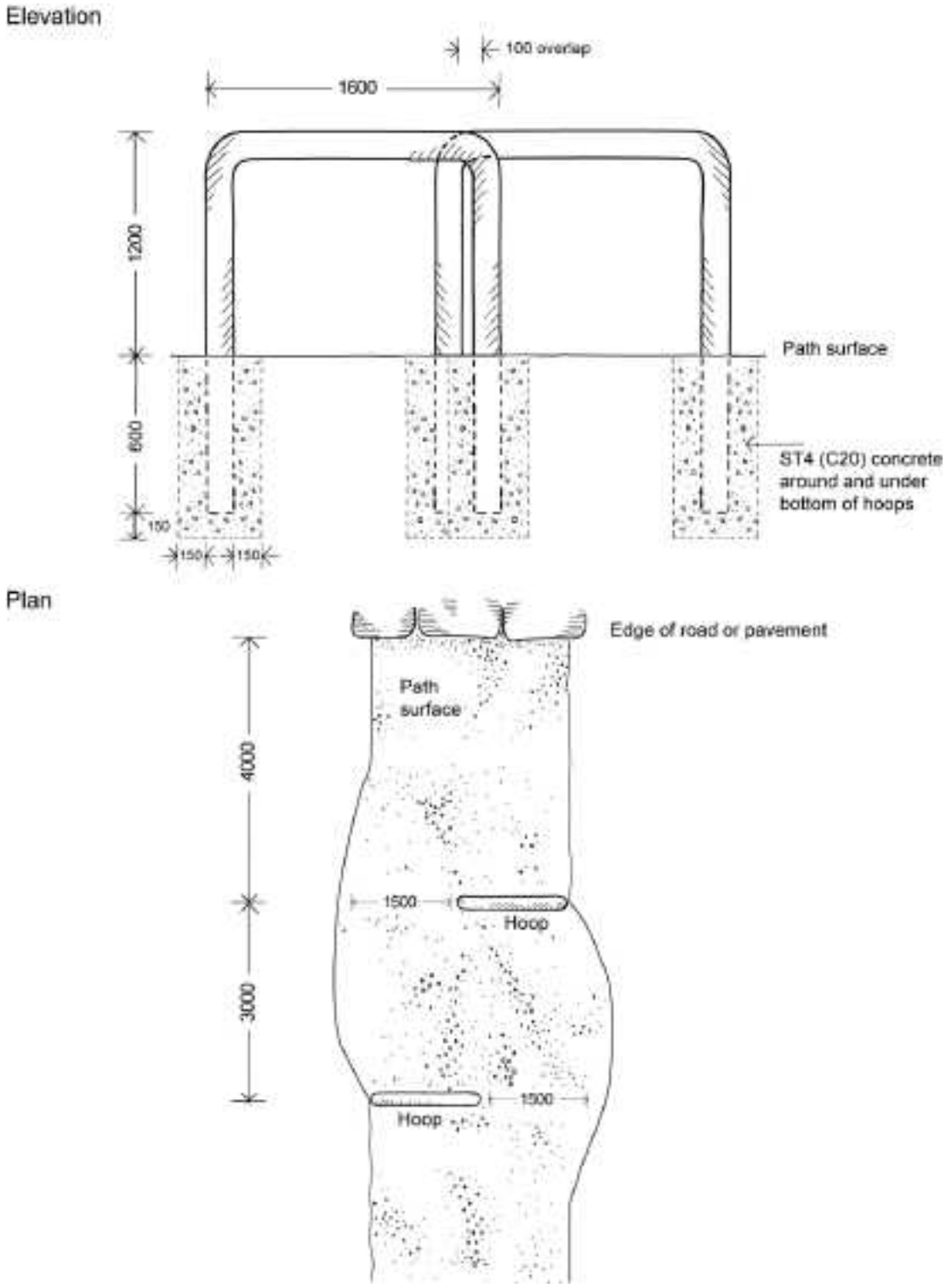
Photo 1: Spring forming from below tree root plate.

Photo 2: Soft wet grasses/mosses with surface breakage

Photo 3: Mineral soils showing through on slope

Photo 4: Mosses and grass indicative of area on whole.

5.4 Metal hoop chicane



This consists of prefabricated metal hoops, creating 1500mm wide gaps at the start or end of a path. The clear space of 3000mm in the chicane, and 4000mm between the chicane and road or pavement, provides room for turning.

Materials List

For one chicane:

- 2 x galvanised steel hoops, 1800 x 1600 x 100mm diameter
- ST4 (C20) concrete, 150mm around and under bottom of hoops.

Installation

Before you start to dig holes, check the area for underground pipes and cables.

- On the left side of the path, 7000mm from the edge of the road or pavement and 100mm inwards from the edge of the path surface, dig a 400mm wide round hole to a depth of 600mm.
- On the right side of the path and at the edge of the surface, 4000mm from the edge of the road or pavement, dig a 400mm wide round hole to a depth of 750mm.
- From the inside edges of those holes and towards the middle of the path, dig 2 x 400mm wide round holes to a depth of 600mm and at a spacing of 1300mm.
- We recommend that the spacing between the middle of those holes is 3000mm, and that the inside edges of the holes overlap by 100mm.
- Place concrete in the bottom of the holes to form 150mm thick base layers.
- Place the hoops in the middle of the holes on concrete base layers. Check that the gap between the hoops is 3000mm wide and that the gaps between the ends of the hoops and edges of the path surface are 1500mm wide. Check that the hoops are overlapping by 100mm. Check that the hoops are 1200mm above the surface, and use a spirit level to check that they are square and standing upright.
- Carefully backfill the holes around the hoops with concrete to the level of the surrounding surface.