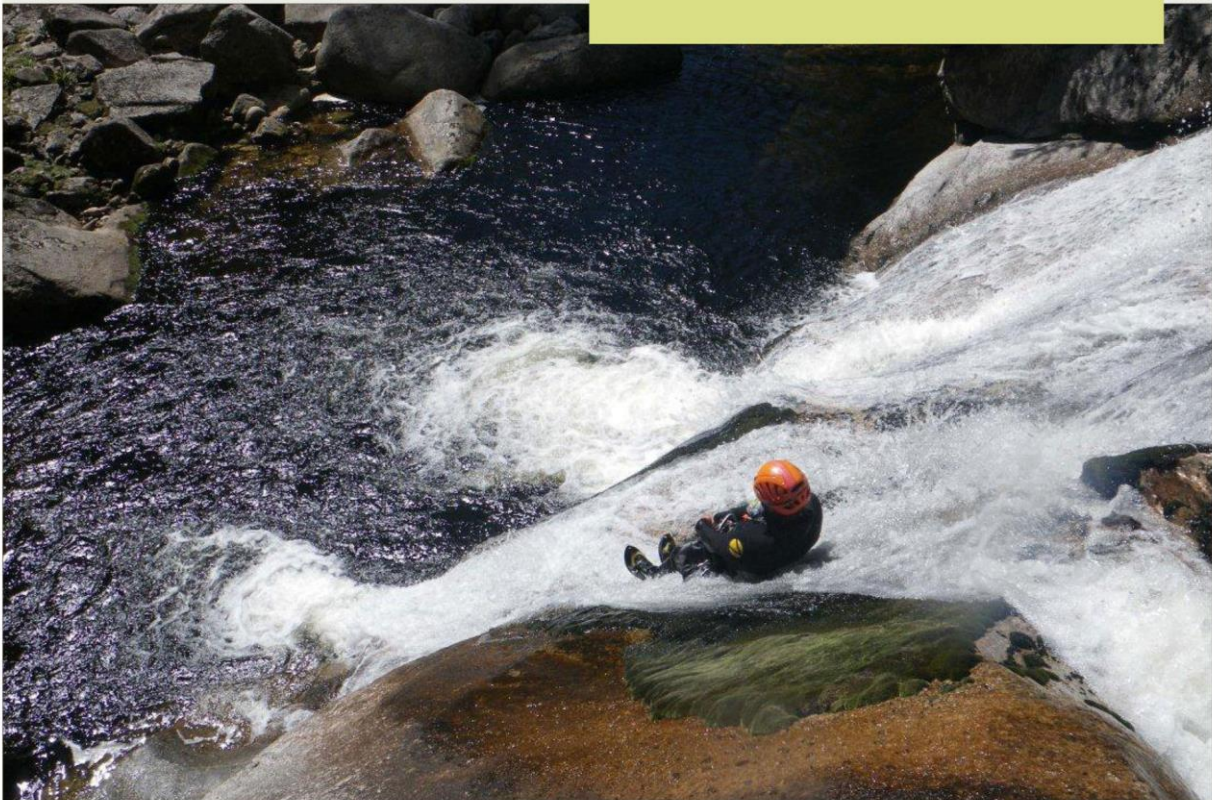


# ASG

Activity Safety Guideline

## Canyoning



September 2019 Version 3

**SupportAdventure.co.nz**

SAFETY SYSTEMS DRIVEN BY SAFETY CULTURE

# Preface

This activity safety guideline (ASG) for canyoning was developed and published by Tourism Industry Aotearoa (TIA) with support from WorkSafe New Zealand. TIA involved experts from the canyoning sector and other relevant technical experts. More information about the development process can be found [here](#).

Activity safety guidelines are a recommendation from the report of the 2009/10 government review of risk management and safety in the adventure and outdoor commercial sector in New Zealand. The variety of activities provided by these sectors is referred to broadly as adventure activities, and include activities provided by adventure tourism operators and outdoor education centres. More information about the government review can be found [here](#).

The guideline is a web-based document and will be reviewed and updated as required. The current version is available at [www.supportadventure.co.nz](http://www.supportadventure.co.nz). This website also has information that is generic to all activities, and should be read in conjunction with this activity safety guideline. Users should periodically check the date and version number of the current online document to ensure that any printed copies are up to date.

TIA, WorkSafe, and the canyoning community have made every effort to ensure that the information contained in this guideline is reliable. We make no guarantee of its accuracy or completeness and do not accept any liability for any errors. We may change, add to, delete from, or otherwise amend the contents of this publication at any time without notice.

## Document control

### Version 3

Changes from Version 2	Where
Deleted generic information	Information generic to all activities is now at: <a href="http://www.supportadventure.co.nz">www.supportadventure.co.nz</a> – see the <b>Risk Management</b> and <b>Good Practice</b> sections, and the <b>Mountain Biking ASG – Core Principles</b>
Updated health and safety terminology	Throughout the document
Added PAS and <i>technical advisor</i> definitions and revised some definitions, eg <i>risk</i>	<a href="#">Definitions</a>
Deleted the section on vertical travel	
Added information on lowering	<a href="#">Section 3.4</a>
Expanded the information on client screening	<a href="#">Section 5.1</a>
Broadened the lanyards concept to personal anchor systems (PAS)	<a href="#">Section 3.2</a>

As well as these significant changes, there are small changes throughout the document.

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**Cover photo:** Falls River, Abel Tasman National Park. Photo: Daniel Clearwater



# Acknowledgements

## Other publications

This guidance contains adventure tourism and outdoor commercial sector information published on the [SupportAdventure](#) website and public sector information published by WorkSafe.

## Consultation

The guideline was developed in consultation with the commercial guiding and instructing canyoning sector and other relevant experts.

The following experts comprised the Canyoning ASG working group and are acknowledged for their advice and support: Cam Bowen, Mike Enright, Neil Foxcroft, Toine Houtenbos, Grant Prattley, and Dave Vass.

The following groups are also acknowledged for their input and support: Canyoning Activity Safety Guideline Support Group; New Zealand Canyon Guides; Aviation, Tourism and Travel Training Organisation; Maritime New Zealand; Mountain Safety Council; New Zealand Outdoor Instructors Association; Outdoors New Zealand; outdoor safety auditors; Qualmark; Tourism Industry Aotearoa; Water Safety New Zealand.

The 2019 review invited 21 stakeholders to provide input, many being operators registered with WorkSafe to provide adventure activities.



Photo: Abel Tasman Canyons, Jake Huddleston

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# Definitions

This guideline assumes the reader has technical knowledge of canyoning. It defines only those terms that may be unique to this guideline, are used in a specific way, or that would otherwise be open to interpretation.

For the purposes of this document the following definitions apply.

## **Competent person (at a specific task)**

A person who can correctly perform the task. They have usually acquired the knowledge and skills to do this through a combination of training, qualification, and experience.

## **Client (or participant)**

A person or participant who takes an active role in an adventure activity but is not in a leadership or supervisory role.

## **Direct supervision**

When the person supervising is in a position to be able to intervene and manage anticipated hazards.

## **Edge**

The place over which a person could fall if they are not attached to a safety system.

## **Fixed anchors**

Anchors that are not placed protection anchors nor part of a building or structure, eg bolts or natural features such as strong trees or boulders.

## **Good practice**

The range of actions currently accepted within the adventure and outdoor sector to manage the risk of harm to staff, clients, and visitors.

## **Incident**

An event that caused or could have caused harm to any person, both accidents and near misses.

## **Indirect supervision**

Is when the person supervising is able to communicate with the person being supervised, but may not be able to physically intervene to manage risks should they develop. There are two types of indirect supervision:

- **Proactive** is where the supervising staff member is actively monitoring the client and is in a position to provide verbal assistance to intervene and manage risks should they develop
- **Reactive** is where the supervising staff member is in a position to communicate verbally and provide assistance to a client when sought, but may not be actively monitoring the client or providing pre-emptive assistance.

## **Operator**

Person or other legal entity (whether an employer, principal, or self-employed person) who provides an adventure activity to a client.

**Personal Anchor System (PAS)**

A piece of equipment that secures you directly to the anchor or rope. It includes cow's tails, lanyards, adjustable tethers, and anchor chains (but not traditional daisy chains).

**Qualified**

A person who holds a current, nationally recognised qualification.

**Risk**

A risk means a chance of harm – a potential failure to ensure the health and safety of clients, staff, and others involved in an activity.

**Risk assessment**

A process undertaken by a competent person to identify risks and their associated risks, and to assess the risks according to their significance — potential severity of impact and probability of occurrence.

**Safety management plan (SMP)**

The written plan outlining the systems an operator will use to manage safety.

**Safety management system (SMS)**

The overarching management system for controlling safety, that is, the SMP, SOPs, and all other documents that are part of an operator's safety planning.

**Sector**

New Zealand adventure tourism and outdoor education providers, support organisations and associations. A specific part of the sector may be referenced, eg the canyoning sector.

**Staff**

Employees, contractors or volunteers who work for an operator and are responsible for the safety of clients undertaking canyoning activities.

**Standard operating procedures (SOPs)**

Written guidance that provides health and safety information about a particular activity or task, such as how it should be conducted.

**Technical advisor**

A person with a high level of competence who usually holds a high-level qualification in the activity. They understand current good practice and have extensive knowledge, skills, and experience sufficient to advise an operator, including reviewing the activity policies, procedures and practices. They can be internal (a staff member) or external.

**Technical expert**

A person who has professional credentials such as a high level, nationally recognised qualification or, if a qualification is not available, extensive knowledge, skills, and experience. They advise auditors on whether safety plans are consistent with good practice and whether operators are working to them.

# Section 1: Introduction

## 1.1 Scope of this guideline

This guideline defines canyoning as:

An activity involving the descent or ascent of a watercourse using specific techniques and/or equipment but excluding a craft. The watercourse often contains water and often has vertical sides and/or difficult egress and access, and is not a cave.

This guideline covers activities that meet this definition, whether or not they are advertised specifically as canyoning. It describes what canyoning operators and technical experts consider to be good practice for actively managing safety in providing commercial canyoning activities in New Zealand.

It will also be useful for:

- other people involved in canyoning, such as trainers and people involved with providing non-commercial canyoning activities
- activities other than canyoning that involve similar risks, hazards, and techniques.

This guideline is written for commercial canyoning operators (the primary audience) and also for safety auditors and technical experts (the secondary audience) as a benchmark for current good practice.

This guideline focuses on preventing serious injury or death. It identifies common significant hazards that clients, and the guides or instructors who lead them, may be exposed to during canyoning trips. It makes recommendations for managing these risks.

Activities associated with taking clients to and from canyoning activities are outside the scope of this guideline. Operators who provide these activities need to manage the associated risks.

*Safety management systems are made of a safety management plan underpinned and driven by a positive safety culture. [www.SupportAdventure.co.nz](http://www.SupportAdventure.co.nz)*

For information on building a safety management system, see: [www.supportadventure.co.nz](http://www.supportadventure.co.nz).

## 1.2 The canyoning sector

Commercial canyoning in New Zealand occurs both in outdoor education centres and adventure tourism operations. Trips in the higher-grade canyons tend to be more common with adventure tourism operations.



The adventure tourism canyoning sector is fairly small and some operations are fairly new. However, it is well connected to the New Zealand recreational canyoning community and the international canyoning community. Many operators, guides, and instructors work within the well-established and regulated European canyoning sector.



There is a small but knowledgeable recreational canyoning community in New Zealand. There is a recreational canyoning website at [www.kiwicanyons.org](http://www.kiwicanyons.org). The [New Zealand Canyoning Association](http://www.nzca.org.nz) (NZCA) formed in 2009.

The New Zealand commercial canyoning sector developed canyoning-specific qualifications with the New Zealand Outdoor Instructors Association (NZOIA) in 2011.

## 1.3 Legislation

Commercial canyoning operations are subject to the Health and Safety at Work Act 2015. They are also subject to the Health and Safety at Work (Adventure Activities) Regulations 2016 (the *Adventure Activities Regulations*).

The health and safety legislation uses both *operators* and *providers* to refer to people or organisations who provide activities such as climbing on artificial structures. This guideline uses *operators* throughout.

### The Adventure Activities Regulations

Canyoning activities expose the participant to risks of the kind defined in the Adventure Activities Regulations. The regulations cover activities where:

- the recreational or educational experience the participant has is the main purpose
- the participant is guided, taught or otherwise assisted to participate in the activities
- the design of the activities deliberately exposes the participant to a serious risk to their health and safety that must be managed by the operator
- failure of the operator's management systems is likely to result in a serious risk to the participant's health and safety.

The regulations require operations providing these activities to undergo an external safety audit and be registered with WorkSafe.



## 1.4 Purpose of this ASG & the SupportAdventure website

This ASG provides practical recommendations for commercial operators to actively manage the safety of the canyoning activities they provide. It should be used in conjunction with the information on the [SupportAdventure](https://supportadventure.co.nz) website.

This website provides practical guidance on topics that apply across all adventure activities, including verifying staff competence, emergency preparedness, incident reporting, communication systems, and trip monitoring. It also provides advice on developing good practice safety management systems, including information and examples for developing a safety management plan

This guideline and the SupportAdventure website act as companions to the health and safety legislation. They are not part of the health and safety legislation, but following their recommendations will help operators to meet legal requirements to take all practicable steps to identify and manage risks.



An investigation into an accident may look at how well an operator followed this guideline. However, risks may be managed in ways other than those recommended in this guideline and achieve the same level of safety or better.

## 1.5 Using this guideline

### Building safety into your SOPs

As an operator, you need to have an overall safety management plan that you use to manage health and safety in everything you do. Ensure your plan contains standard operating procedures (SOPs) – or activity plans – for each activity you provide.

This guideline outlines good practice recommendations specific to canyoning. Conduct a site-specific hazard identification and risk management process, consider the recommendations in this guideline, and add the relevant procedures to your SOPs.

Before departing from the recommendations given here, seek advice from a canyoning technical advisor. Variations must be at least as good as the guidelines, and an operator will need to be able to justify why they use a different procedure from the guideline.

It is essential that, alongside site specific assessments and the use of this guideline, guides and instructors conduct dynamic hazard identification and risk management.

This guideline gives examples which are not exhaustive – think of other examples that could apply to your specific activity. The responsibility for making safe decisions remains with the operator.

### Passing safety audits

The Adventure Activities Regulations require a canyoning operator to pass safety audits by an audit

provider recognised by WorkSafe. Following this guideline will help operators to do this.

The [Safety Audit Standard for Adventure Activities](#) outlines the standards or requirements that adventure activity operators must comply with to reduce risks when providing adventure activities.

This ASG sets out relevant technical standards and recommendations for commercial canyoning activities. It will help safety auditors to assess whether an operator is complying with good practice.



## Section 2: The Canyoning Environment

The source of one of the most likely causes of death while canyoning is drowning when in canyons during an unexpected rise in water levels. Focus safety management strategies on preventing this.

This section identifies good practice safety management strategies for dealing with key aspects of the canyoning environment.

The information should not be considered all-inclusive. It is essential to carry out site and activity-specific risk management processes, and for guides and instructors to conduct ongoing dynamic hazard identification and risk management.

*Note:* Some of the most likely serious injuries are impact injuries associated with jumps or slides. For more information on this and other activity-based risks, see [section 3](#).



Photo: Daniel Clearwater

### 2.1 Grading canyons

New Zealand canyons are graded using the French grading system. This guideline refers to two levels of canyons:

- Level 1 – up to approximately French grade V3, A3, 2
- Level 2 – above this grade.

For more information on the French grading system, go to [www.kiwicanyons.org](http://www.kiwicanyons.org). However, factors such as wind, temperature, and water level may make it inappropriate to rely on the canyon grade.

### 2.2 Risks from rising water level

The potential for a rise in water level is a significant hazard when canyoning. Water level can rise for several reasons, including heavy or persistent rain or snow melt in the canyon water catchment area, dam collapse and/or release, or landslides or avalanches into the water source.

Ensure that guides and instructors are well aware of the causes of rising water for the canyons they work, and that they know how to plan for, monitor, and react to rising water level.

To do this they should know:

- local catchment areas and any associated dangerous-weather patterns or dam and slide hazards
- likely water rising rates for particular weather patterns and catchment surface conditions
- the best weather-forecasting service available (most up to date and most accurate) and how to use it for the canyons they work in
- how and when to cancel a trip due to water-level concerns
- methods for monitoring water rising rates, water-level indicators, and maximum safe water level

- procedures for dealing with rising water level, such as safe waiting areas, escape routes, and evacuation procedures
- landslide or avalanche hazards that could affect the catchment, how to monitor them, and associated cancellation parameters.

## 2.3 Risks from cold temperatures

Cold air or water temperatures can lead to clients becoming hypothermic or struggling to safely participate. This is accentuated when the water level is high.

Strategies for managing cold temperatures should be based on the associated risk. Options include:

- ensuring that clients are equipped for the expected temperatures
- managing the start times and duration of trips to suit the temperature
- encouraging people to minimise their time in cold water
- using extra thermal clothing, food, and heat sources
- training guides and instructors to manage cold-temperature hazards.

## 2.4 Risks from rockfall

Assess and monitor the canyon for the likelihood of rockfall. Assessment and monitoring should be based on the associated risk — consider the type, shape, and quality of the rock of the canyon, as well as vegetation.

Strategies for managing rockfall should be based on the significance of the risk. Options include:

- avoiding the area by choosing a different route through the canyon or cordoning off the area
- moving quickly through the area
- wearing helmets.

## 2.5 Changes to hazards

Significant environmental events such as floods, tree fall, and rockfall may affect known existing hazards on a canyoning trip, or create new hazards.

Ensure that systems are in place to check canyons and specific activities within canyons are checked after environmental events that could have changed or created hazards. Record any changes and notify relevant staff and other canyon users.

## 2.6 Communication challenges

### Communicating within the canyon

Communicating within a canyon is often difficult due to distance, gradient, and water noise.

Ensure that guides or instructors are trained in the use of an agreed set of signals. These will often include hand, whistle, and rope signals. Examples of some commonly used signals can be found in Grant Prattley's [Canyoning Technical Manual](#).



## External communication

The limited access of many canyons can make emergency evacuation difficult and can lead to lengthy waits for external emergency support.

Strategies for managing difficult canyon access should be based on the associated risk. Options include:

- increasing the guide-to-client ratio
- deploying multiple guides or instructors on level 2 canyons
- mapping options for access and escape
- pre-rigging emergency access ropes or ladders
- caching emergency evacuation equipment
- induction training and ongoing practice for guides or instructors on access and escape routes
- training or informing local emergency services about your access systems and their limitations
- considering accessibility when determining guide or instructor to client ratios, assessing clients, and setting competence requirements for guides or instructors
- ensuring that sufficient equipment is available to ensure group safety during a delay leaving the canyon, such as a bothy bag or tarp and high-energy food.



## Section 3: Providing Canyoning Activities

Some of the most likely serious injuries are impact injuries associated with jumps or slides.

This section looks at common canyoning activities. It identifies significant hazards and good practice for managing the associated risks.

However, while focusing on all the details of each part of the trip, do not lose sight of the big picture, such as an extraordinary flood event.

The information should not be considered all-inclusive. It is essential to carry out site and activity-specific risk management processes, and for guides and instructors to conduct ongoing dynamic hazard identification and risk management.

The most common non-serious injuries while canyoning usually occur while scrambling and walking.

*Note:* The most likely cause of death while canyoning is drowning due to an unexpected rise in water levels. For more information on this and other environmental risks see [section 2](#).

### 3.1 Swimming and wading

Canyoning often involves swimming and wading in water, and therefore exposes people to the risk of drowning.

#### Identifying the hazards

Hazards to consider when swimming or wading include:

- clients with limited or no swimming ability
- water that is fast flowing
- water that is too shallow or too deep
- unstable or slippery river bottom
- aerated water – reduced buoyancy
- features that could trap people.

#### Managing the risks

Include strategies for managing risks in technical systems, client management techniques, and client briefings.

#### Technical systems

- Establish maximum safe water levels for swimming, wading and other water related activities — operate within these levels.
- Choose swim or wade activities and routes that match client abilities.
- Manage client equipment to eliminate or minimise entrapment risks to acceptable levels.
- Use additional buoyancy devices as per the recommendations in [section 6.1](#).
- Check clients' swimming competence before activities that demand strong swimming ability.
- Assess swims and wades to ensure that guides or instructors can supervise and intervene as

needed to manage safety.

- Use rope techniques to assist clients through water sections – throw bag or a length of abseil rope.
- Directly supervise difficult swim or wade exit points where exiting at that point is integral to safety.
- Only allow clients to swim over drops when the landing area is deep and obstacle free.

### Client management

Guides and instructors should understand the characteristics of the group and manage the safety of each member, eg:

- identify and manage weak swimmers — consider avoiding the swim or wade, swimming with the guide or instructor, or using extra buoyancy as per [section 6.1](#).
- ensure that supervision levels and strategies are in line with the group's needs.



Photo: Abel Tasman Canyons, Jake Huddleston

### Client information

Ensure clients are informed that water may be over their head and they will need to swim. Ask clients if they have limited or no swimming ability.

Include information on suitable risk avoidance techniques in safety briefings for swimming or wading should. Examples include:

- wading and/or swimming techniques suited to route to be negotiated
- ways to recognise hazards where appropriate, such as trees or undercut walls
- actively swimming away from hazards
- entrapment avoidance techniques such as white-water float position and active swimming.

*Note:* See also [sections 2.2](#) and [2.3](#) for recommendations on managing the risk associated with rising water levels and the effects of cold temperatures.

## 3.2 Exposure to edges

Negotiating canyons often involves exposing clients and guides or instructors to edges and the risk of falling from height. Specific techniques for moving near edges also bring their own hazards.

Additional sources of information and technical expert advice on managing activities at height include the New Zealand Canyon Guides, the New Zealand Outdoor Instructors Association, and the New Zealand Mountain Guides Association.

## Reducing the risk of falling

Manage general exposure to the risk of falling by ensuring that people stay far enough away from edges to isolate or minimise the risk. This will often include establishing safe zones back from an edge and communicating these clearly to clients.

Sometimes exposure to edges cannot be avoided. Belay client and instructors or guides, or attach them to a safety point, when in the opinion of a technical expert or suitably qualified person:

- they are likely to fall and the fall is likely to cause serious injury, or
- a guide or instructor needs to be attached in order to protect the client safely.

Assess the likelihood to fall by looking at factors such as:

- how close people are to the edge
- how much the surface slopes down
- how unstable or slippery the surface is
- the ability of the client and guide or instructor.

Guides and instructors should use other safety techniques to protect clients from lesser falls that may still cause serious injury, eg spotting techniques when clients move in technically difficult terrain.

## Using a personal anchor system (PAS)

A personal anchor system (PAS) is commonly used with safety lines and anchors as a fall restraint.

### Identifying the hazards

Hazards to consider when using a PAS include:

- clients totally unclipping in a hazard zone (a full unclip)
- clients being unable to reach clip and unclip points
- carabiner gates opening accidentally
- high peak forces on people and equipment in the event of a fall.

### Client management

You should:

- Check clients' ability to use a PAS correctly, particularly around avoiding a full unclip.
- Practise first in a low-consequence environment.
- Ensure that individual client's supervision levels and strategies meet their needs.

*Note:* The High Wire and Swing ASG and the Abseiling ASG may give different good practice guidance for the horizontal use of a PAS depending on the context.

## Deep-water belaying

This is a term for a safety system where a deep-water landing is used to protect people falling from height. Belay ropes are not used.



## Identifying the hazards

Factors to consider when identifying hazards for deep-water belaying include:

- unexpected or uncontrolled take offs or landings
- protruding rock on the cliff face if the abseiler loses control
- shallow or aerated water, and obstacles in the landing zone.

## Managing the risks

Include strategies for managing risks in technical systems, client management techniques, and client briefings.

### Technical systems

Choose locations low enough that clients can land safely even if surprised by the fall.

Assess landing zones to ensure that their depth and nature means that a client's fall will be safely managed by landing in the water — consider water aeration.

### Client management

Space clients at distances that ensure they will not cause each other to fall and, that if more than one falls, they will not land on each other.

### Client briefing

Instruct clients how to take off and land safely if they lose balance or control of the activity above the water.

If abseiling, instruct clients to abseil slowly and explain what to do if they lose control of the rope.

## Using clients to bottom-brake belay

Clients are often used to bottom-brake belay on canyoning trips.

## Identifying the hazards

Factors to consider when identifying hazards for using clients to belay include:

- the belayer using incorrect belay technique
- the belayer using safety equipment incorrectly, such as harnesses and rope attachment systems
- the belayer being distracted or not focusing on the task.

For information on using clients to bottom-brake belay for abseiling in waterfalls see [section 3.2](#).

## Managing the risks

Include strategies for managing risks in technical systems, client management techniques, and client briefings.

### Technical systems

Safety when bottom-brake belaying relies more on client management and briefings than technical systems.

## Client management

Pay particular attention to assessing clients and allocating belaying tasks to a suitable person.

Directly supervise client belayers if they are less than 14 years old.

Either directly supervise client belayers 14 years old and over, or use an adequately trained and supervised client as a back-up belayer. Indirect supervision may be acceptable if all the following conditions are met:

- the client belayer has been approved for indirect supervision by an experienced guide or instructor verified as competent in the skills of the NZOIA Level 1 Canyoning qualification, or a guide or instructor verified as competent in the skills of the NZOIA Level 2 Canyoning qualification.
- the guide or instructor has previously taught or observed the client belayer performing the task required and has absolute confidence that the client will perform the skills correctly in normal and adverse conditions.

Ensure the client belayer and the guide or instructor can communicate by line of sight throughout the belay process.

## Client briefing

Instruct clients on the belay techniques for the system and equipment in use. Stress the importance of correct and diligent belaying techniques and the consequences of belay failure.

## 3.3 Ziplines

Canyoning trips often involve ziplines, which expose people to the risks associated with falling from height and moving at high speed.

Additional sources of information and technical expert advice on managing zipline activities or constructing ziplines include commercial zipline operators, the New Zealand Canyon Guides, the High Wire and Swings ASG and technical rescue training associations such as the Search and Rescue Institute of New Zealand and Rescue 3 New Zealand.

### Identifying the hazards

Factors to consider when identifying hazards for ziplines include:

- incorrect attachment to the zipline
- exposure of people to edges and falling
- impact of peak forces on people and equipment
- lack of ground clearance in take-off areas
- clients hitting obstacles in the path of travel or stopping zones



Photo: Abel Tasman Canyons, Jake Huddleston

- clients not stopping in time or stopping too abruptly due to inadequate braking systems
- clients suspended in a harness for an extended period
- clients' hands, hair, or equipment being in positions where they could be caught in pulleys.

## Managing the risks

Include strategies for managing risks in technical systems, client management, and client briefings.

### Technical systems

Ensure that:

- Zipline routes and landing zones are free of obstacles that could cause injury.
- Zipline angles and client retrieval systems enable efficient client travel and rescue.
- Launching and stopping systems ensure clients do not endure impact likely to cause harm.
- Ropes, wires, anchors, and other system components manage the likely forces of normal zipline use and emergency procedures<sup>1</sup>.
- Rescues are practised regularly.

Consider using releasable systems.

### Client management

Ensure that:

- The connection of the client's zipping device to the zipline before they launch.
- Clients are protected from unsafe exposure to edges as per the guidance in [section 3.2](#).

### Client briefing

Ensure that clients:

- Use safe hand positions to ensure that their hands will not become entrapped in pulleys or braking systems.
- Know what to do to stop sliding back along the zipline when they reach the end point.

### Good practice alert for using ziplines

There have been two near miss incidents involving clients connected to ziplines by one point of attachment. This has resulted in WorkSafe and the ASG working group recommending:

**Use two points of attachment between the client's harness and the safety line.**

*Note:* Ensure that attachments do not cause an entanglement hazard or otherwise interfere.

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<sup>1</sup> Strength requirements for load-bearing ropes in ziplines will almost certainly exceed the recommendations made for general use ropes in [section 6](#). Examples of ways to manage the additional forces include using higher-strength ropes, lower-stretch ropes, double ropes, or metal cables for low-angle, horizontal, or highly tensioned ziplines.

## 3.4 Abseiling and lowering

These activities all involve the risk of falling from height and have their own unique hazards.

Also see [section 3.2](#), which describes strategies for managing the risks of using clients to bottom-brake belay.

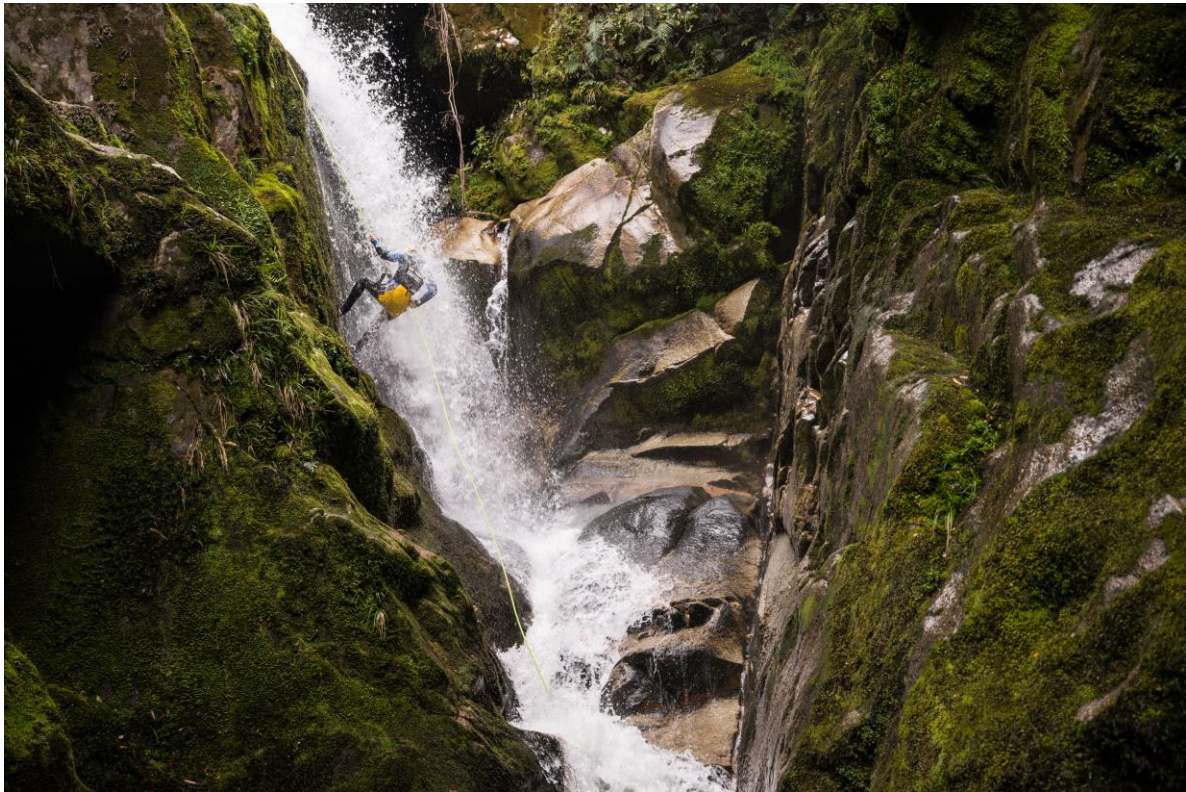


Photo: Abel Tasman Canyons, Adrien Paris

### Lowering

Lowering is used in place of abseiling if the client is not suited to an abseil because they are scared, tired, or lack the skill. It is also used as a technique in its own right as the safest and most efficient way to descend, enabling the instructor or guide to maintain more control over the descent.

It is best rigged as a two-to-one system, with the guide or instructor releasing the client from the rope from the top (*loose roll*).

### Conventional and guided abseiling

Canyoning often involves client abseiling and occasionally includes guided abseils.

### Identifying the hazards

Factors to consider when identifying hazards for abseiling include:

- exposure of people to edges and falling
- incorrect client abseiling technique or equipment use
- a difficult abseil starting area affecting the ease of weighting the rope and client ability to practise the abseil technique



- abseiler suspended in a harness for an extended time
- top heavy clients inverting while abseiling
- objects falling from above and landing on abseiler or others waiting below
- long abseils — compromised ability of the guide or instructor to communicate with the client
- guided abseils — increased load on equipment and anchors and not avoiding the hazard.

## Managing the risks

Include strategies for managing these factors in technical systems, client management techniques, and client briefings.

### Technical systems

Technical systems need to take into account equipment loadings, the time a client spends hanging in a harness, and the abseiler's ability.

- Ensure abseiling systems are releasable or include another option for recovering the abseiler in stuck abseiler scenarios, eg hauling systems or lowering using another rope.
- Choose abseil sites and starting point set ups to enable clients to safely weight the abseil rope.
- Choose abseil sites and supervision positions that enable suitable supervision of the client's descent, eg if possible, chose sites that enable the instructor or guide to see and talk with a nervous client during difficult sections.
- Provide clients with equipment to maintain them in an upright position if they may invert.
- Ensure that on guided abseils anchors and equipment are suitable for the extra load on the system and line tension and angle is sufficient to avoid the relevant hazards.
- Keep the edge at the top of the abseil site clear of loose equipment and objects such as rocks.
- Protect ropes and webbing from sharp or abrasive surfaces — use edge protection such as padding or re-directing ropes.

### Client management

Ensure clients have a safety backup system while abseiling. This will usually involve being belayed by a guide or instructor or, sometimes, by another client. Clients using a self-managed backup system such as prusik, will generally only occur in an instructional rather than a guided environment.

The decision to allow a client to use a self-managed backup system or to check their own abseil device connection should be made by an experienced guide or instructor verified as competent in the skills of the NZOIA Level 1 or 2 Canyoning qualification — for information on guide and instructor competence and qualifications, see [section 4.2](#).

Check the connection of each client's abseil device to the rope before they abseil unless all the following conditions are met:

- the guide or instructor has previously taught and/or observed the client performing the skill set required and has confidence that in normal and adverse conditions the client will perform the skills correctly
- buddy checks are used
- the initial weighting of the client's abseil setup is backed up by another form of safety, eg the

client being attached by a PAS.

### **Client briefing**

Instruct clients:

- On correct abseil body position and on techniques for speed control and braking.
- To secure loose items, such as hair and clothing that could catch in the belay device.

### **Abseiling in waterfalls or into water**

Abseiling in waterfalls or into water adds the risk of drowning. The degree of risk involved will usually increase with the amount of water, the number of entrapment features, and the length of the abseil.

### **Identifying the hazards**

Factors to consider when identifying hazards for abseiling in waterfalls include:

- features in the rock behind the waterfall trapping the abseiler — cracks, chockstones, hanging pools
- water hitting the abseiler or belayer, affecting their ability to abseil or belay
- surface slipperiness leading to foot entrapments or inability to maintain abseil stance
- water hiding the abseiler
- difficult communication between client and the instructor or guide
- client bottom belayers needing to assist with complex rescue scenarios
- abseiler becoming entangled in rope when abseiling into water
- client being flushed over a waterfall after releasing from the abseil.

### **Managing the risks**

Include strategies for managing risks in technical systems, client management techniques, and client briefings.

### **Technical systems**

If abseiling into a high-water flow, and there is no bottom-brake belayer:

- ensure the abseil line finishes at or above water level
- the abseil device allows for easy rope release.

Ensure there is no knot in the end of the rope.

Remove packs when abseiling in waterfalls with high-water flows.

Use a PFD to provide buoyancy if moving water and features within it are significant hazards.

Place a rope across the exit of a slow-moving pool when there are hazards downstream.

Manage the abseil from the bottom – stacking clients or ensuring they are competent to load themselves onto the rope.

Bottom-brake belayers should stand back from the waterfall, have stable footing, and good visibility

of the abseiler.

Factors to consider include:

- the swimming ability of the client
- the likelihood of a client to be trapped by hazards such as the river bottom, hydraulics, recirculation, siphons, strainers, and hanging pools in waterfalls
- the aeration of the water – how much buoyancy can it provide?
- the likelihood of a client being flushed downstream or being in moving water for a long time.

### **Client management**

Client assessment and progressions should be used to ensure clients are suited to managing their role when abseiling in waterfalls.

If possible, abseilers should be within sight of the guide or instructor in the parts of their descent involving significant water flows, ledges containing pools of water which present a drowning risk, or rock features which present an entrapment risk.

Instruct them to keep moving in a waterfall.

Send the strongest client down first to assist others.

If bottom-brake belayers need to assist in complex rescues, such as those requiring them to assist with moving the abseiler out of the main flow, observe them competently performing the tasks required to assist in the rescue before they belay.



### **Client briefing**

Briefing information will vary greatly depending on the actual hazards of a particular waterfall. Points to consider include instruction on managing slippery surfaces, avoiding entrapment features, and ways to maintain a breathing space such as body and head positions, and the need to keep moving.

If abseiling into water instruct clients on how to get clear of the rope.

If using clients to bottom brake belay an abseil where they may need to assist in a rescue and move the abseiler out of the main flow, ensure they have been previously trained and observed competently performing their part of the required rescue techniques.

## 3.5 Sliding and jumping

Sliding and jumping are the two canyoning activities most likely to cause serious injury. They involve hazards associated with height, take-off, speed, water, and the inability to directly manage the client throughout the activity.

### Identifying the hazards

Hazards that should be considered when jumping and sliding include:

- exposure of people to edges and falling
- difficult and exposed access routes
- unstable take-off areas
- lack of confidence or ability of client
- long horizontal distance of landing zones from the take-off position
- obstacles in route of travel
- landing zone too shallow or containing obstacles
- non-aerated water in landing zone, particularly for high jumps causing hard landings
- high speed of client on landing
- equipment hitting the jumper on landing, particularly packs when jumping
- fast flowing water in the landing zone flowing into hazards.



### Managing the risks

Include strategies for managing risks in technical systems, client management techniques, and client briefings.

### Technical systems

Technical systems need to consider access and take-off areas, landing zones and run-out.

- Directly control client take-off positions if it is integral to safety, eg the guide or instructor being attached to a safety point at the top of a jump to enable the hands-on guidance of the client.
- Protect clients from falling as they access take-off areas, eg include using fixed lines and a PAS or direct guide or instructor assistance.
- Assess landing zones to ensure they have sufficient depth and no dangerous obstacles.
- Assess landing zones to ensure any impact on the client is acceptable; consider both water aeration and likely client speed.
- Position a guide or instructor to stop clients from being washed downstream in landing zones with exits that actively flush clients towards hazards. For lesser flows this may be substituted by techniques such as a rope across the exit of the pool.
- Slides — consider the use of padding to protect the client, particularly their spine, eg neoprene, PFDs.



- Jumps — clients should not wear packs when jumping, and guides or instructors should consider forces resulting from landing wearing a pack before doing so themselves.
- Jumps — actively manage difficult landing zones, eg position a guide or instructor at the bottom to indicate the safe landing area and/or mark a hazard.
- Jumps — be wary of using buoyancy aids for particularly high jumps into non-aerated water because they can cause neck injuries.

### **Client management**

Client assessment should be more stringent for jumps which have difficult access, take-offs or landings.

Manage clients so that they do not interfere with each other's stability in access and take-off areas, nor land on each other in landing zones.

### **Client briefing**

Instruct clients in take-off and landing positions including body, head and limb positions.

Inform clients that they can do a less risky activity where relevant, such as a lower jump, abseiling, or being lowered.

*Note:* clients should be informed before a trip commences if a trip contains high-risk activities with no alternative options.



Photo: Abel Tasman Canyons, Mike Walton

# Section 4: Staff

## 4.1 Knowledge of the trip

Ensure that guides or instructors are familiar with the hazards of the canyon they are working and with the operator's standard operating procedures. The number of trips and amount of training this requires will vary.

Factors to consider include:

- the grade of the canyon and the specific hazards associated with the trip
- the competence of the guide or instructor
- the canyon familiarity of other guides or instructors working the trip.

## 4.2 Qualifications

NZOIA administers New Zealand's canyoning qualifications:

- **Canyon Leader:** for instructors and guides who lead short trips in easy vertical and aquatic canyons in normal conditions, and assist in more difficult canyons.
- **Canyon 1:** for instructors and guides who run canyon trips with short pitches, eg less than 30 metres, that can be negotiated using simple rope descent techniques and with physical and water difficulty up to moderate difficulty, eg canyons up to approximately grade V3, A3, 2.
- **Canyon 2:** for instructors and guides who organise and lead people in more difficult canyons, eg above grade A3, V3, 2 at normal flows, teach and guide all aspects of canyoning, and organise and supervise canyoning programmes.

For more information on these qualifications, including more detailed skill-set breakdowns, experience prerequisites, and minimum recommended first aid certification, see [www.nzoia.org.nz](http://www.nzoia.org.nz)

NZOIA has been working with the Switzerland Outdoor Association (SOA) and the International Canyoning Organization for Professionals (ICOpro) to work on equivalency. See the [qualifications matrix](#) on the NZOIA website.

# Section 5: Clients

## 5.1 Ensuring clients are suited to the trip

Assess clients to check that they are suited to participate in the canyoning trip and its particular activities. This should happen before the trip begins and be ongoing during the trip itself.

### Assessing clients

Use information gathered while assessing clients to inform trip options, client supervision levels, and activity choice within the trip.

Clearly identify what to assess in the operator's safety management plan. Staff other than guides or instructors, such as front-of-house staff or drivers, may be involved in assessing clients. Client assessment should be consistent across staff, and should reflect the requirements of each trip.

Factors to assess include:

- fitness and physical ability
- psychological factors such as the ability and likelihood to follow instructions, confidence in the environments of the canyoning trip, and phobias or fears – particularly of heights and water
- medical issues, particularly pre-existing conditions and histories, eg shoulder



dislocations, neck or spinal injuries, epilepsy, diabetes, heart problems, allergies, and blood thinners – they should flag this customer and before committing to the booking discuss it with another person, ideally the Operations Manager or a senior guide

*Note:* Clients sometimes downplay their condition because they think they may not be allowed to participate. They may not realise the consequences of their condition worsening during the trip, and the risk of their participation to themselves and others. The operator needs to make a decision to participate or not, or to participate with special precautions.

- the technical skills required for the trip or a particular activity, such as swimming.

Information on managing clients with mixed abilities can be found at [www.supportadventure.co.nz](http://www.supportadventure.co.nz) and in the Mountain Safety Council Outdoor Safety Manual – *Risk Management for Outdoor Leaders*.

### Age restrictions

Establish minimum-age guidance for each canyoning trip.

Factors to consider include:

- the grade of the canyon
- activities within the canyon and their specific hazards



- whether the client fits the safety equipment
- the ease of canyon access and escape
- the ability to access external emergency support
- supervision levels
- experience and skill of guides and instructors.

There are no overarching age recommendations for canyoning in New Zealand. However, there are recommendations on the minimum age of client belayers – see [Using clients to bottom-brake belay](#).

*Note:* It is common practice for operators to require children aged under 18 to have guardian consent to participate in adventure activities — New Zealand law does not give clear guidance on this topic.

## Identifying and managing unsafe clients

Do not permit a person to participate in a canyoning trip if they are in such a state of impairment that they may be a hazard to themselves or to any person on the trip. Impairment could be due to alcohol, drugs, or fatigue.

Identify as a hazard any client who is unable to perform safety procedures as outlined in the safety instructions. Management strategies should suit the significance of the risk and include directing the client towards less risky activities, increasing supervision levels, or removing them from the trip.

Removing an unsafe client from a trip can be very difficult if the client disagrees, but doing so may result in avoiding an incident.

## 5.2 Informing clients about safety

Managing safety is more effective if clients are well informed, particularly on the risks and requirements of the canyoning trip.

### Pre-trip risk disclosure

Before setting off on a trip, inform every client of the following information:

- canyoning is an adventure activity involving risk of serious injury or death. Clients should be aware that the canyoning operator cannot guarantee the client's safety
- the trip is mentally and physically demanding and requires the client to be comfortable and confident with moving over uneven and possibly slippery terrain, being in the water, and dealing with heights



Photo: Mike Enright



- the client needs to follow the guide or instructor's instructions at all times and understand that this is critical to their safety and that of the group.

Mention specific hazards and emphasise whether or not they can be avoided or place extra responsibility on the client. These include sole-guided trips and activities such as swimming or wading in moving water, jumping from height, abseils, and slides.

Inform clients of any difficulties regarding escaping from the canyon and communicating with external emergency support.

## **General safety information**

Instruct clients in canyoning awareness and general techniques. This may occur before and during the trip. Factors to cover include:

- awareness of and warnings about the hazards of the canyon
- the importance of listening to the guide or instructor
- procedures for routine movement through the canyon, such as how to move on slippery and unstable rocks, staying back from edges, and taking care around the exits of pools
- communication systems such as the 'OK' signal
- methods for maintaining body temperature
- emergency procedures such as staying where they are and waiting for instructions from the guide or instructor.

## **Safety information for specific activities or hazards**

For parts of the canyon involving a significant hazard, or requiring technical manoeuvring to negotiate, inform clients of:

- the hazard and warn of its dangers
  - options for avoiding the hazard such as alternative routes or techniques
  - the location of safe zones, such as waiting areas back from edges
  - the techniques required to negotiate the hazard or participate in the activity, such as procedures for use of technical equipment and performing technical actions
- Note:* for guidance on points to cover for specific activities see [section 3](#).
- applicable emergency procedures or self-rescue techniques.

## **Using demonstrations and activity progressions**

Use demonstrations and activity progressions where practicable, particularly for more difficult activities. This helps ensure clients are prepared and fully understand what they are required to do.

## 5.3 Supervising clients

### Minimum supervision levels

Tighter ratios for bigger groups may be required.

Number	Skill level (NZOIA or equivalent)	Level 1 canyon	Level 2 canyon
Sole guide or instructor	Canyon 1	1:8	N/A
	Canyon 2	1:10	1:8
2 or more guides or instructors	Canyon 1	1:8	N/A
	Canyon 2	1:8 (1)	1:8 (2)

(1) At least one guide or instructor has skills at the level of the NZOIA Canyon 2 qualification.

*Note:* numbers are not increased as the overall trip size is assumed to be larger and therefore requires additional management.

(2) This supervision level assumes that all guides or instructors have skills at the level of the NZOIA Canyon 2 qualification.

*Note:* a guide or instructor with skills at the level of the NZOIA Canyon 1 qualification is considered an assistant guide or instructor in this type of canyon.

For more information on establishing levels of supervision, see: [www.supportadventure.co.nz](http://www.supportadventure.co.nz)

## 5.4 Parameters for sole guiding or instructing

Sole guided or instructed trips involve an increased risk of clients being inadequately supervised or spending extended periods of time in the canyon in an emergency scenario.

Only sole guide trips where clients, guides or instructors, and the canyon rigging all enable a safe trip.

### Assessing and informing clients

When establishing parameters for assessing clients for a sole guided or instructed trip, factors to consider include:

- increasing minimum age requirements
- increasing technical ability or training requirements
- increasing psychological suitability requirements — such as high confidence in the canyon environment and likelihood to follow instructions.

Inform clients of the risk that they may be inadequately supervised and may spend extended periods of time in the canyon in an emergency scenario. Inform clients how they can assist with managing these risks. This should include:

- emphasising the heightened responsibility that sole guiding places on them

- emphasising the importance of following instructions
- training them in signals required to assist with communication within the canyon
- training them how to maintain body temperature and how to use and access heat sources
- training them in what to do if the guide or instructor becomes unable to assist them, such as instructing them to stay where they are, training them in how to call for outside help, instructing the group how to escape the canyon, and supplying a map showing escape routes.

### **Requirements for sole guides or instructors**

Ensure that guides or instructors working sole guided trips are experienced and verified as competent to manage the trip alone. Factors to consider include:

- their level of experience and ability in the skills required for leading the trip, including managing emergency scenarios
- their degree of familiarity with the environmental particulars of that canyon trip
- their degree of familiarity with the operator's standard operating and emergency procedures
- the ease of external communication from the canyon.

### **Rigging canyons for sole guided or instructed trips**

Ensure that canyon rigging allows clients to be supervised or contained in a safe place. Examples include using:

- stacked or tethered abseils
- clearly identified safe areas
- additional safety attachments such as a PAS and hand lines.



## Section 6: Equipment

Ensure that equipment is suitable and in good condition. Equipment choices should be based on:

- the canyoning activities on the trip
- identified hazards and associated management strategies
- emergency scenarios and response plans
- factors on the day such as guide or instructor skills, client ability, and environmental conditions.

### 6.1 General use equipment

Use equipment according to manufacturers' recommendations and current industry use.

Use equipment that complies with recognised standards such as from the International Mountaineering and Climbing Federation (UIAA), the European Committee for Standardization (EN), and the New Zealand and Australian standard (AS/NZS). Equipment should be manufactured specifically for rock climbing, abseiling, canyoning, or whitewater.

#### Client equipment

Correctly fit equipment as per the manufacturers' instructions. Check equipment for fit as suitable throughout the trip, eg before using a harness.

##### Client equipment for all trips

Clients should have:

- Thermal clothing or wetsuits that are sufficient to protect clients from trip risks such as hypothermia, impact, and abrasion.
- A helmet designed for the most relevant significant hazard presented by the canyon – falling rocks.

##### Client equipment for trips requiring buoyancy

When clients are exposed to a heightened risk of drowning, and where the risk is not managed by techniques such as clipping clients to fixed lines to keep them out of the water, ensure their equipment provides sufficient buoyancy, eg neoprene or a personal flotation device (PFD).

Use a PFD to provide buoyancy if moving water and features within it are assessed as significant hazards. Factors to consider include:

- the swimming ability of the client
- the likelihood of a client to be trapped by hazards such as the river bottom, hydraulics, recirculation, siphons, strainers, and hanging pools in waterfalls
- the aeration of the water – how much buoyancy can it provide?
- the likelihood of a client being flushed downstream or being in moving water for a long time.

*Note:* Use of a PFD should be considered to assist with managing shallow water landings, managing impact on the torso (such as during slides), and managing the ability to hold on to a person — such



as when 'catching' a client at the exit of a pool and redirecting them away from a hazard.

### **Client technical equipment for the vertical environment**

Technical equipment for the vertical environment will depend on the activities of the trip. It needs to enable risk management and emergency response strategies to be carried out, and will often include a harness, descent device, carabiner/s, and a PAS.

### **Guide and instructor equipment**



Guides' or instructors' equipment recommendations are the same as those for clients, with the addition of:

- clothing sufficient to enable participation in emergency response, for example a dry top and thermal beanie
- a whistle suited to a wet environment
- a knife of a type suited to, and rigged in accordance with, the trip's emergency scenarios.

### **Life-bearing ropes – excluding ziplines**

Choose ropes based on the expected use of the rope and the information in this section. Life-bearing canyoning ropes (excluding ziplines) are usually:

- in the 18–22kN range for rope breaking strength
- static, low stretch, or semi-static
- kernmantle or braid-on-braid design
- compliant with one of the following standards: EN 1891, AS4142.3, AS4142.2, ANSI Z133, CI1801.

For information on rope length, see [section 6.2](#).

## **Anchors, bolts, and rigging**

See the *Bolting Code of Practice* by the New Zealand Canyoning Association.

Ensure anchor construction, rigging, and bolting is carried out by a person competent to do so and follows these recommendations:

- one-point anchors should only be used if deemed to be failsafe
- rigging of multiple anchors should result in load sharing for guided rappels, ziplines, and rescues involving a two-person load
- bolt anchors should have at least two bolts where they are expected to hold a fall or a two-person load
- bolt diameters and types should be suited to the rock in which they are placed and be able to support normal operational and emergency use, eg using bolts and hangers rated to 22KN for life-bearing loads
- anchors should be placed where they can be protected from expected floods and debris – if this protected placement is not possible, the anchor should be identified as a hazard and monitored within the operator's risk management system
- metal should be preferred over webbing or rope in permanent anchors, or those which are left in place for extended periods of time – if it is not practicable to use metal, the use of webbing or rope should be identified as a hazard in the operator's risk management system
- rigging and rope systems should be protected from sharp edges or particularly abrasive surfaces.

Additional information and expert advice on bolting in the natural environment is available through the New Zealand Canyon Guides and the New Zealand Alpine Club. Information on bolts and fall arrests can also be found in AS/NZS 4488 and AS 1891.4.

Information on good practice anchor construction can be found in the book *Climbing Anchors* by John Long.

## **6.2 Emergency equipment**

### **Accessibility**

Ensure that trip emergency equipment is suitably available and accessible. The nature of the canyon trip and environment will determine whether equipment is attached to the guide or instructor's harness, carried in a backpack, and/or cached in the canyon.

*Note:* packs used to carry gear in canyons where water is a significant factor should have flotation.

### **General emergency equipment**

Ensure that emergency equipment is sufficient and suitable for managing group safety and chosen based on identified emergency scenarios. The following items should be considered:

- throwbags
- shelter and heat sources such as space blankets, heat packs, bothy bags, ground insulation, high energy food, and additional thermal clothing
- a diving mask

- pliers
- a length of hollow tube – for breathing assistance in submersion scenarios
- a backboard or stretcher – consider including rated attachment points for hauling and helicopter strop use, and stationing it strategically within the canyon.

### **First aid supplies**

Ensure that first aid supplies are suitable for the identified first aid scenarios of the trip. Suggestions for first aid kit contents can be found at [www.supportadventure.co.nz](http://www.supportadventure.co.nz).

### **Vertical environments**

Ensure that there is equipment available to manage emergencies on the most technical or longest vertical pitch, eg:

- for canyons with committing abseils without escape — static rope/s equalling twice the length of the longest non-avoidable abseil, and potentially some extra length as backup
- webbing
- hardware such as carabiners, descent devices, ascent devices, and a hauling or progress capture device.

When choosing hardware consider rope types and whether they are likely to be wet or dry, particularly when considering mechanical rope grabs versus prusik cord.

## **6.3 Equipment maintenance**

Maintain, inspect, and test equipment regularly and thoroughly enough to ensure its reliability.

Pay particular attention to safety equipment that is permanently installed, or that is left set up for extended periods of time, eg anchors, bolts, ropes, webbing, and cables.

Where a site has multiple users, it is recommended to share information and responsibilities on shared equipment maintenance, inspection, and testing. Keep records of equipment information as per the recommendations at [www.supportadventure.co.nz](http://www.supportadventure.co.nz).

Additional information on equipment inspection can be found at [www.aspiring.co.nz/equipment-inspection](http://www.aspiring.co.nz/equipment-inspection). Although it is designed for situations outside the scope of this guideline, useful information on equipment, maintenance, testing, and inspection can be found in the *Industrial Rope Access in New Zealand; Best Practice Guidelines*.

### **Establishing maintenance, inspection, and testing schedules**

Inspect equipment before it is used. Focus on identifying any major issues that could affect the performance of the equipment, and any other issues that require testing or maintenance.

Ensure ongoing maintenance, inspection, and testing techniques and schedules are consistent with manufacturers' recommendations and reflect factors such as:

- normal operational wear and tear
- operational incidents such as exposure of ropes to sharp edges or emergency loads
- anticipated emergency loadings

- environmental factors such as the nature of the rock supporting a bolt or anchor
- time elapsed since the last check
- exposure to environmental factors that could have damaged the equipment, eg sea spray, rockfall, freeze-thaw action, avalanche, or flooding.

Ensure inspection includes concealed components such as those in protective sleeves, eg anchors around trees that are wrapped in protective material.

## **Proof testing of bolts and other fixed anchor points**

Proof test bolts and other non through-bolted engineered fixed anchors such as posts (or obtain evidence that they have already been tested). Examples of proof testing techniques include the use of load cells.

Conduct a risk assessment to determine when proof testing should occur, if sampling is suitable and, if so, what sampling schedule should be used. The risk assessment should consider factors such as:

- anchorage type, such as chemical or friction
- frequency of use
- exposure to environmental factors
- years in service
- expected wear and tear.

If sampling is used, ensure that it is sufficient to give assurance of overall anchor and equipment reliability and does not extend beyond six years between tests for any particular anchor. This maximum time frame aligns with the Department of Conservation's backcountry structure proof-testing regime.

Ensure that anchors are able to support a 22KN load. When proof testing anchors, use test loads 50% of the strength limit state capacity of the anchors, eg to check an anchor is sufficient for a 22KN load, test to 12KN and, if the anchor has multiple legs, test each leg to 6KN.

*Note:* do not test legs to less than 6KN due to the difficulties of accurately predicting load sharing between linked anchor legs.

When proof testing anchors, ensure that:

- Testing is done with certified and calibrated equipment and by a competent person – testing equipment, eg load cells, can be hired from industrial tools and equipment companies and some general hire companies.
- Proof test loads are applied gradually and held for at least two minutes — a positive test will show no signs of the anchor yielding or reduction of the load applied.

Using load cells to apply an axial pull is a practicable test for bolts. However, it may not be a practicable test for other fixed anchors such as pickets or posts. Other testing options include loading anchors in shear. If testing anchors in shear, ensure that:

- loads are applied in the direction the anchor will be used
- loads are sufficient (friction will decrease the load) — options include using a load cell in between the anchor and the load
- anchor movement is measured against a fixed point — use a measuring device such as a dial



gauge that indicates movement in at least millimetres increments – a positive test will show no deformation of the anchor and no movement at ground level\*\*.

Additional sources of information and experts on bolt testing and load cell use include industrial rope access companies and engineers.

\* These recommendations are based on engineering advice.

\*\*It is acknowledged that some anchors may show marginal movement at ground level and still be able to safely support a 22KN load. If an anchor shows movement at ground level, seek expert advice or treat the test as a fail.



Photo: Abel Tasman Canyons, Adrien Paris