BC Forest Safety

STEEP SLOPE LOGGING RESOURCE PACKAGE

Assessing Risks and Planning Mechanical Harvesting on Steep Slopes

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Disclaimer

The BC Forest Safety Council provides this guidance document as a resource to assist BC forestry employers in planning and conducting mechanical harvesting operations on steep slopes. This package describes a process for identifying, evaluating and documenting hazards and provides tools for developing and implementing site-specific steep slope plans.

Information contained in this document does not necessarily provide the only correct way to address machine stability risks. While this resource package will help operators conform to industry best practices and the intent of current Regulations and Guidelines, it may not identify all requirements or actions that will be appropriate and necessary in various situations. It does not reduce or replace users' responsibilities under applicable legislation - individual organizations (companies, employers) are responsible to ensure application of suitable processes and practices. The information provided is subject to review in light of changing government requirements and regulations. Every effort has been made to ensure the reliability of the information herein and to avoid errors and omissions. Address all concerns and suggestions to the BC Forest Safety Council.

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Availability

This resource package, as well as future revisions and additions, are available from:
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Overview

This Resource Package has four (4) main sections.

Part 1 – Risk Assessment and Site Pre-Work

A 2-page form used to evaluate site-specific hazards and to prescribe controls necessary to manage identified risks. It can also be used to document the steep slope logging pre-work meeting that happens between the supervisor and operators. To help users complete the form and develop effective plans, there are instructions about the risk assessment process, as well as definitions and descriptions of site characteristics and conditions an assessor must consider in their assessment.

Part 1 has a brief list of general hazards and risks factors that assessors and planners should consider, plus site- and machine-specific practices that may be implemented to manage machine stability risks.

Part 2 – Best Practices for Steep Slope Operations includes both general and machine-specific procedures. The section identifies ***standard practices*** and ***additional controls***. Standard practices are those basic operating procedures that employers should apply during all steep slope operations.
Additional controls are those extra steps planners and supervisors will selectively apply to address and improve machine stability on higher risk sites. Machine-specific procedures identify practical steps targeted to specific machine types (e.g. feller-buncher, skidder).

Part 3 – Steep Slope Planning & Operational Responsibilities identifies three primary elements of *typical* BC harvesting operations - owners (e.g. forest proponent / licensee), employers (e.g. contractor) and employees (e.g. machine operator) – and describes planning and administrative responsibilities that each would carry out.

Completing activities and responsibilities described in Part 3 forms the initial level of controls (e.g. planning and engineering blocks in a way that minimizes hazards; and communicating and implementing specific practices that mitigate risks).

Part 4 – Support Documents includes generic forms and practical information for use in steep slope operations. Many employers will already have similar steps or tracking mechanisms built into their operations, but for those that do not, Part 4 provides forms for their reference / consideration.

1. Operator Experience / Qualification Record
2. Supervisor Experience / Qualification Record
3. Steps for Dealing with Emergencies
4. WorkSafeBC Steep-Slope Logging Checklist

Introduction

Operating logging equipment on steep slopes increases the likelihood of reduced machine stability, which can result in a roll-over. Such events can result in serious injury or a fatality, significant environmental damage and expensive lost production and machine repairs. This document recognizes that conducting productive, injury-free mechanical harvesting operations on steep slopes requires an integrated approach that draws on the skills and accountabilities of all forestry team members - owners, operational planners and lay out crews, contractors, assessors, supervisors, and operators.

This guide was developed with input from forest industry technical advisory groups from across BC, including engineers, safety professionals, equipment manufacturers, industry associations, forest professionals, logging managers, contractors, supervisors and equipment operators. These groups collaborated to describe responsibilities and best practices necessary for planning and safely conducting mechanical harvesting operations on sloping terrain.

Diligent initial planning is required to ensure the "right" harvest system is selected early in the development process. Planners and lay out crews working on steep slopes must consider harvest methods other than mechanical (e.g. cable system, helicopter, track-based versus rubber-tired, etc.) and, where practicable, designate those systems rather than building plans that would unnecessarily compromise employers' ability to ensure machine stability. Once that evaluation is complete and mechanical harvesting is determined to be the "right" approach, Steep Slope Resource Package processes can be applied. At all times, operations must be conducted in compliance with WorkSafeBC OHS Regulation Part 26.16, including 26.16(5).

This resource package is intended to **supplement**, not replace, employers' existing planning, hazard assessment or safe work procedures. It is intended to help owners, employers and employees meet compliance obligations with respect to WorkSafeBC Regulations (e.g. OHS Part 26.16 and 26.2). Users are encouraged to incorporate these procedures and tools into their existing safety management system, but practices described in this package do not replace requirements of WorkSafeBC Regulations or other relevant regulations. Should actions described in this document conflict with an applicable regulation, the regulation prevails.

Note: There is a wide variety of ownership systems, contractual arrangements and employee structures at work in the BC forest industry. This document considers the *typical* forest harvesting structure to be a contractor harvesting timber under contract to a forest licensee. Recognizing that private land timber harvesting, timber sales issued by BCTS, woodlot licenses and other harvesting arrangements each confer different responsibilities to each constituent, it is essential that users of this guide are familiar with the whole procedure, and understand their role(s) given their contractual situation.

Scope

This process contemplates logging machinery identified below operating in typical mechanical operations.

- **Tracked machines** – While the resource package addresses primarily feller-bunchers, skidders, hoe-chuckers and processors, the planning and operational practices herein are likely applicable to other tracked forestry equipment – excavators (trail / road construction, site prep), harvesters and dozers.
- **Wheeled machines** – harvesters, skidders, forwarders.

Non-standard or atypical configurations are not addressed. While this framework might be used effectively for such applications, employers need to develop safe work practices specific to those operations.

Part 1
Risk Assessment and Site Pre-Work Form

Using the Risk Assessment and Site Pre-Work Form

Who – As described by WorkSafeBC Regulation 26.16, the steep slope hazard assessment must be completed by a *qualified* person. WSBC OHS Regulation Part 1 provides the following definition of a qualified person: "*being knowledgeable of the work, the hazards involved and the means to control the hazards, by reason of education, training, experience or a combination thereof*".

The Guideline related to Part 26.16 provides further information on the qualified assessor:

- Possess extensive experience in working on steep slopes in variable terrain and conditions
- Be knowledgeable of the machines being used during the total harvesting operation; not just one phase such as bunching. The familiarity with the equipment must include the selection of the equipment, limitations on maneuverability and stability, and use of accessories which would increase traction or stability, e.g. chains or grousers
- Be familiar with the training needs and experience of the logging equipment operators
- Be familiar with the specific site to be harvested which would include knowledge of the terrain, soils, and weather variables for the location including the planned season of harvest
- Be knowledgeable in developing safe work procedures that are based upon a site-specific risk assessment.

The qualified person collecting and recording site-specific attributes as inputs to the hazard assessment may not necessarily be the same person that designates required controls and builds the steep slope plan and procedures. For example, site information (slope, soils, hydrology, etc.) could be collected at the planning / lay out stage by an experienced forester, and then communicated to a logging contractor or supervisor qualified to use that information to build and implement an effective steep slope plan.

Where – As specified by WorkSafeBC OHS Regulation 26.16, on all slopes over 35% (wheeled equipment) or 40% (tracked equipment) where mechanical harvesting is planned and the manufacturer's maximum slope operating stability limit is not known.

What – Complete the Steep Slope Hazard Assessment, develop site-specific Steep Slope Procedures and conduct a Pre-Work Meeting to brief operators on those procedures.

When – Before harvesting operations commence. Assessing the area and developing a plan in advance of operations enables scheduling the right machines and operators, and affords time to revise the plan should that be necessary. See also Page 15 regarding changing environmental conditions.

How:

Follow these steps:

1. Page 1 - Complete the top part of the form to identify the area / unit under the assessment and plan.
2. Use a map that shows block boundaries, roads, steep slope sites, riparian areas, sensitive soils, etc. Consult other key information (e.g. preliminary steep slope assessment map, Terrain Stability Field Assessment map, etc.).

3. Field review (walk) the area planned for mechanical harvesting operations. Identify sites (see Site Identification and Mapping, below) with slopes / characteristics that pose machine stability risks. If site conditions change during the operation, it may be necessary to re-evaluate and complete another assessment.
4. On the form, check off those conditions that pose a risk for machine stability. For each condition with a "Yes" checked, write the site specific procedures that will be followed to allow safe operations on that slope.
5. Consider State of Mind, Operator Competency and Duration of Exposure for operators that will conduct the work.
6. Consider other Site Features (e.g. convex slopes, bluffs, gullies, benches, escape routes) plus operational constraints (e.g. soil disturbance limits, retention strategy, danger trees, upslope terrain stability or avalanche risk). Identify each one; consider how they will affect operations.
7. If stability risks cannot be adequately controlled, designate and map area as "No Go". Develop an alternate harvest plan or amend boundaries to exclude (e.g. designate as WTP).
8. Conduct a pre-work meeting to communicate the hazards site specific procedures to all the workers and supervisors who will be involved in the steep slope operation.

Steep Slope Logging – Risk Assessment and Site Pre-Work

Date			**Licensee/Owner**		
Cutting Permit			**Contractor**		
Block		**Steep Slope % (range)**		**Location within Block**	

Machine		**Max Slope % allowed**		**Operator**		**Estimate of hours to do work**	
Machine		**Max Slope % allowed**		**Operator**		**Estimate of hours to do work**	

Appropriate Information Supplied by Owner (map, slope %, hazards)	Yes ☐	
Assessor Qualified to Conduct Steep Slope Assessment	Yes ☐	

Risk Assessment of Steep Slope			**Site Specific Procedures (Refer to Part 2 – Safe Work Practices for Steep Slope Operations)**
Note: Site specific procedures must be developed for each type of machine that is operating on the steep slope.			
Slopes greater than 35% for wheeled machines	Yes ☐	N/A ☐	
Slopes greater than 40% for tracked machines	Yes ☐	N/A ☐	
Unstable Ground (slumps, Terrain Stability Field Assessment, talus)	Yes ☐	N/A ☐	
Ground Roughness (boulders, rock outcrops, hummocks, gulleys)	Yes ☐	N/A ☐	
Unsafe slopes below operating area	Yes ☐	N/A ☐	
Shallow Soil Depth over Bedrock	Yes ☐	N/A ☐	
Soil conditions (sandy or saturated organic soils, consider how logging may affect water flow and soils on site)	Yes ☐	N/A ☐	
Poor winter ground conditions (poor snow, minimal frost depth on site)	Yes ☐	N/A ☐	
Slash (amount, elevated, size)	Yes ☐	N/A ☐	
Poor visibility (snow, fog, night shift)	Yes ☐	N/A ☐	
Harvest Plan Requirements (reserve areas, leave trees, planned skid trails)	Yes ☐	N/A ☐	
Oversized Trees (size, weight and species)	Yes ☐	N/A ☐	
High Stumps (what is the allowable stump height)	Yes ☐	N/A ☐	

Isolated Work (how close is machine assistance to overcome a difficulty)	Yes ☐	N/A ☐	
Other:	Yes ☐	N/A ☐	
Steep Slope Pre-Work			**Check that the following requirements are in place and communicated with all workers on site.**
Steep slopes and No Go areas are easily identified, mapped and map provided to workers.	Yes ☐	N/A ☐	
Manual Tree Falling Required	Yes ☐	N/A ☐	
Duration of Exposure minimized (consider shift length, # of breaks, # of consecutive days on shift)	Yes ☐	N/A ☐	
Machine capabilities appropriate for timber type (tree size and weight)	Yes ☐	N/A ☐	
Confirm good working condition of machine(s) (hydraulics, tires/tracks, ROPS, guarding, seatbelts, escape hatches)	Yes ☐	N/A ☐	
Operator Competency (check experience and training)	Yes ☐	N/A ☐	
Operator State of Mind – alertness, understanding of plan – Avoid fatigue, rushing, complacency	Yes ☐	N/A ☐	
Operator – can measure slope %, stop operations if unsure/uncomfortable and contact supervisor	Yes ☐	N/A ☐	
Skid trail construction (locations and specs discussed)	Yes ☐	N/A ☐	
Supervision and Man-check frequency	Yes ☐	N/A ☐	Who: How Often:
Emergency Response Plan in place	Yes ☐		

Reassessment Date and Update to Site Specific Procedures:	
Date:	Updates:
Date:	Updates:

Signatures:	
Operators	
Qualified Assessor	
Supervisor	

Definitions & Notes

Below are notes explaining hazard assessment criteria and providing direction on how to use the hazard assessment tool to develop a steep slope plan.

Site or Sub-Area – See Site Identification below. Use a unique name to identify the assessment unit or area. Use that identifier on the corresponding steep slope plan map.

Slope – Steepness or gradient of the site as measured using a clinometer, typically expressed as a percentage.

Slope Length – The slope distance from the lower extent to the upper edge of the site being assessed. Where significant benches (slope less than 25%) exist between steeper sections and provide an operational advantage, the slope length is the average distance between benches.

Terrain Classification – Where a Terrain Stability Field Assessment (TSFA) is necessary (e.g. as required by Regulation), it should be completed by the site owner and the report provided to the qualified assessor and contractor. Where mechanical operations are anticipated, the TSFA should describe any operational limitations (e.g. NO GO zones, skid trail strategy). The assessor must consider relevant recommendations of the TSFA.

Instability Indicators – Visible characteristics that may suggest slope instability. Instability indicators include landslide scars; exposed soils or notably younger vegetation; pistol-butted or jack-strawed trees; fractured rock formations; seeps or springs at the toe of the slope; shallow, wet organic soils or wet site vegetation (e.g. devil's club) on slopes >40%.

Ground Roughness – Includes boulders, rocky outcrops, gullies, hummocks, depressions and other physical features that impact machine stability.

Soils – Mineral soils underlying surface organic matter, evaluated to determine its ability to provide machine traction. Soil information can be directly collected via a soil pit, and by observing root balls of windthrown trees or recent road cuts, or as indicated in the Site Plan.

Soil Depth – Measured as the average distance from top of the mineral soil (i.e. not including organic matter) to bedrock or hardpan layer as would restrict machine stability and traction.

Snow: Due to machine weight and disturbance incurred during operations, the attributes of underlying soils usually continue to influence machine stability. But where soils are frozen to an adequate depth and/or when there is significant snow cover, Soils and Soil Depth will become less relevant, and the snow will influence machine stability. The assessor needs to consider overall snow depth, recent accumulations, snow consistency (e.g. firm or sugary), ice, freeze / thaw cycles, etc. to evaluate how the snow will influence machine traction and stability. Use the Soils and Soil Depth rows to describe characteristics and scores, add comments.

Pre-Existing Debris – Windthrow, downed woody debris and stumps considered as obstacles with respect to how they would impact the ability of operators to effectively maneuver around (or over).

Understory – Saplings, shrubs and other low vegetation, considered with respect to the operator's ability to see the ground, and how it would impact machine stability / maneuverability.

State of Mind – The operator's mood or mental state that influences their attitude, behavior and performance. Favorable indicators include positive attitude; being alert; mind on task; well rested, well fed and hydrated; understands risks / hazards; clear on the plan and how to implement it successfully. Troublesome indicators include distractions, fatigue, impairment, complacency, and being unsure of the plan and how to implement it.

Operator Competency – The skills and knowledge demonstrated by the operator during recorded observations and assessments during work. Consider relevant training the operator has completed, their experience and their success operating in similar and varied conditions. Consider their ability to read and understand maps and plans, communicate with supervisor and workers on site, self-trigger on changing conditions / hazards, etc.

Duration of Exposure – The length of time an operator will be working on a specific steep slope area; shift length, frequency of scheduled breaks, number of continuous shift, etc. The extent to which duration affects each operator varies with their skills, experience and state of mind, as well as dynamic conditions (e.g. weather). An operator working his 7th consecutive 10-hour shifts with few breaks and poor weather is at greater risk of error than if they were on the 3rd day 8-hour shifts, regular breaks and favorable weather.

Worker Isolation – The time required for first aid assistance to reach the operator, should a machine upset occur. In some situations, mechanical assistance may be necessary before first aid is possible (e.g. another machine to right the upset machine before the door can be opened).

Environmental Factors – Weather conditions that impact machine stability, traction, operator visibility and fatigue, and operational difficulty. These include high winds, heavy rain or snow, extreme temperatures (e.g. more than 35°C or less than -30°C), fog, rapidly changing weather, etc.

Timber - Timber characteristics and quality (e.g. decay, root rots, stem rots, broken tops, limbiness) impact operational difficulty. For example, stem breakage results in debris accumulations and obstacles; excessive limbs reduce visibility.

NO GO area – An area where mechanical operations will not be undertaken as machine stability is not ensured.

Site Identification and Mapping

Use this hazard assessment process to identify and evaluate machine stability risks on a site-by-site basis.

A "site" is an area that has similar characteristics (e.g. slope, soils, timber, roughness, etc.) such that it has one Overall Machine Stability Risk Rating and the associated plan identifies the same operational controls to ensure machine stability. A different site exists when different controls are necessary to ensure machine stability; develop a separate steep slope plan.

It is possible to *group* physically separate but similar sites, provided the same controls apply. Complete one hazard assessment form and develop one plan that describes the common set of controls for all of those sites. When similar sites are grouped, clear, consistent identification on maps is critical. Use colors, cross-hatching or other means to identify sites with the same controls; identify sites that require different controls with a different color or cross-hatching.

Example 1 - Block 123 might have a general slope of 31%, but 4 areas within the block have rocky outcrops and slopes of 46%. If the assessor determines the actions for each of those 4 areas area the same (e.g. tilt-cab buncher run by John, 527 track skidder operated by Stan, etc.), one hazard assessment and one steep slope plan can cover all 4 sites.

Example 2 - The west half of Block 767 (call it Site A) has uneven slopes of 38%, poorly drained soils and heavy windthrow. The east half of Block 767 (Site B) has 53% slopes over well-drained soils and an open understory. The qualified person determines that machine stability can be assured only if two different sets of controls are applied. The assessor completes 2 hazard assessments and 2 plans for Block 767 using one map that identifies the 2 sites within the block (using different colors).

A site should usually be larger than 8 metres (or 1 ½ track lengths) before it requires a distinct assessment / plan. The rationale for this is as follows.

- Mobile equipment can maneuver around obstacles and small steep slope areas, and can therefore *avoid* spatially brief hazards.
- Machines with booms, line skidders and grapple skidders with extendable grapples can be operated to *reach in* to access trees; this avoids the need to travel across brief steep areas.
- It is difficult to map very small areas without contributing clutter that detracts from the rest of the map.

Note: For some applications, it is not possible to employ the advantages of reaching-in or micro-site avoidance. For example, some silviculture treatments require 100% coverage to achieve objectives. A disc-trenching steep slope plan must consider machine stability for all steep pitches within the treatment area, and potentially identify NO GO zones even though the block was mechanically harvested.

Where stability hazards occur in very small areas, identify such "points" in the field and on the map. Though a steep slope plan might not be appropriate, develop work procedures to manage those risks and describe them in the logging plan.

General Machine Stability Risk Factors

Site Factors

- Steep slopes – generally slopes over 35%.
- Long pitches of continuous slope
- Slopes or benches less than 35% but located above areas of greater slope
- Broken and uneven terrain, boulders, rock outcroppings, ravines, gullies, etc.
- Hydrology – pre-existing conditions or changed by harvesting operations
- Poor ground surface traction
  - Exposed or shallow rock (thin soils over bedrock, talus, gravel, etc.)
  - Soil types – wet, clay type or high organic content
  - Subsurface flows, springs, poorly drained soils
- Windthrow, stumps, decadent timber, and other woody debris; dense understory or ground cover that obscures operator visibility of the ground.
- Oversized or heavy wood that exceeds the handling / lift capacity of the equipment
- Danger trees
- Poorly constructed or inadequate machine trails

Mechanical Factors

- Machine design limitations
- Equipment / harvest method not matched to site and timber (e.g. inadequate engine power or hydraulic system performance)
- Necessary preventative maintenance or repairs not complete
- Component damage, worn hoses, sloppy controls, poor brakes, dull cutting teeth, etc.
- Fuel levels inadequate to complete task
- Worn out lugs or improper tracks for application

Environmental Factors

- Snow
  - ice / freeze / thaw cycles
  - significant powder accumulations with no base
  - inconsistent temperatures (freeze / thaw)
  - snow over *unfrozen* / incompetent soils or obscuring hazards beneath
  - snow over frozen ground
  - upslope avalanche
- Heavy rain, extreme heat or cold temperatures
- Adverse or rapidly changing weather conditions
- Poor visibility / lighting conditions (nighttime, fog, snow, etc.)

Human Factors

- State of Mind – mind on task; avoid distractions, rushing, complacency, fatigued
- Operator Competency – experience and skills with machine, timber sites
- Hazard Identification Skills – self-triggers to identify changing conditions and unforeseen hazards; knows how to manage or stop and ask for direction from supervisor.
- Operator Attitude – healthy knowledge of and respect for hazards, listens to supervisor, observes plan
- Supervisor Competency and Attitude – understands plan and how to implement, recognizes when adjustments are needed, acts to implement, communicates with operator; avoid production-only attitude
- Lack of pre-planning, inadequate time to effect required amendments (hurry to start job)
- Inaccurate hazard identification or mapping; incorrect measurement / assessment of hazards

Part 2
Safe Work Practices for Steep Slope Operations

This section identifies general and machine-specific ***standard practices*** and ***additional controls***. Employers should consistently implement standard practices during all steep slope operations. Additional controls are those extra steps planners and supervisors will selectively apply to improve machine stability in higher risk areas. Contractors or site supervisors are responsible to provide direction and oversee implementation of prescribed operation; operators / employees have accountability to comply with direction.

Marking / Mapping Best Practices

- Mark NO GO Zones in the field using unique and highly visible ribbons. Ensure maps and legends clearly indicate the marking protocol.
- Planners / layout crews should map locations where a machine can safely turn around. For example, upper block boundaries could incorporate a suitable bench area.
- Avoid trying to communicate too much information on operational maps. Keep maps clean and simple, but provide the information necessary for steep slope machine operators. It may be necessary to generate separate maps for steep slope works.

Standard Practices - General

- Recognize that some areas are not suitable for mechanical operations. Rather than pushing or exceeding operator / mechanical limits, designate those areas as NO GO Zones or develop an alternate harvest plan.
- Match equipment, operators and work methods to the job and the hazards. Know the physical capabilities of each machine (certified slope operating stability limit, lift capacity, boom length, width, etc.) and understand them in the context of the site and timber.
- Conduct work on steep slopes during adequate lighting conditions.
- Install 2-way radios in all steep slope machines; designate a channel, and ensure operators have reliable communications with the supervisor and/or another worker at the worksite.
- Conduct a thorough machine inspection immediately prior to steep slope works. Confirm equipment is in sound operating condition. Confirm all necessary guarding (including Roll-over Protection System) and necessary safety equipment is in place and functional.
- Operator will confirm good working condition of the seat belt, and wear it at all times when operating the machine. Operators will secure essential / personal equipment (e.g. lunchbox, radio, fire extinguisher, PPE) in the cab; secure other equipment (tools, oil, etc.) outside the cab.
- Identify equipment and/or personnel that are available to render assistance in the event of breakdown, when equipment operators find themselves in difficulty and for dealing with an upset condition.
- **Grouser Configurations** – Grousers on tracked machines are a key determinant of traction and machine stability. When matching the equipment to the site and application, consider the following guideline.
    - Narrow track configurations tend to increase ground pressure per area and are suitable for very firm soils or rocky sites, while grousers on wide tracks exert a lower pressure per area so are more suitable for soft surfaces (wet ground, thick organic layers).
    - **Single grousers** are usually used for rock type surfaces and hard surfaces
    - **Double grousers** are usually used for more traction on medium to firm grounds
    - **Triple grousers,** also referred to as “street grousers”, are not suitable for harvesting applications.

- Weld additional tips or picks on single (or double) grousers to increase traction.
- Consider using additional track stability devices designed to limit sideways slippage.

Additional Controls - General

- Conduct work on high-risk sites during daylight hours only.
- Avoid operations during severe weather events (moderate to high winds, rain that will affect visibility or ground competency, snow accumulations, extreme heat). Specify foul weather shutdown conditions.
- Schedule critical steep slope operations to occur during periods of optimal operator mental alertness (e.g. avoid first thing Monday morning or last thing Friday afternoon).
- Apply shorter shift lengths / increased breaks. Operate in very difficult areas for shorter durations, alternate with adjacent less difficult areas.
- If the designated machine or operator is not available, delay steep slope work until they are.
- Use purpose-built equipment or attachments (e.g. extended tracks, telescoping boom, stabilization or weight-distribution devices).
- Tether or anchor machines working on steep slopes; provide machine assistance to ascend or descend where required (e.g. cable snubbing or pulling).
- Complete more frequent preventative maintenance for equipment operating consistently on steep slopes (e.g. ensure tracks / rails are tight, check tilt-cab mechanism, etc.).
- Increase man-check frequency for operators on steep slope (provide details in the plan).

Feller-buncher - Standard Practices

- Regularly check your immediate work area for hazards (unstable stems, danger trees, rocks dislodged during felling, changing weather) and work with your supervisor to develop a plan that addresses hazards.
- Ensure tracks are in good condition and outfitted to provide traction (e.g. 2-3" picks on every 2nd grouser).
- Operate only on terrain where you can maintain traction / stability to move up and down the slope.
- Conduct work "straight up" or "straight down" the slope; working from the bottom of a steep slope area confers additional safety benefits. Do not approach slopes >50% from above.
- Plan narrower falling swaths. As slope increases, decrease swath width to allow the operator to keep the felling machine's centre of gravity close to the slope face.
- Avoid travel over windfall, felled trees, boulders, rock outcrops or other obstacles that cause instability or obscure the operator's view of the ground. Cut and move aside woody debris. Minimize slash creation.
- Confirm the lift / handling capacity of the feller-buncher. Determine a safe loading capacity given the slopes (i.e. somewhat less than 100% capacity) and describe / understand that limit in terms of a maximum stem diameter for mechanical felling.
- Do not attempt to fell trees beyond that safe loading capacity; mark on map / notify supervisor for attention by hand-faller. Reduce the amount of wood collected in the head; avoid "collecting" trees in the head and avoid packing multiple stems.
- Do not attempt to fell trees that are beyond safe reach (e.g. further than ¾ of full extension).
- Avoid double cutting; fell trees using a single cut or leave for hand-faller.
- Avoid swinging trees to the downhill side of the machine.

- Avoid lifting the boom straight up and tilting trees back over the machine (to the downhill side).
- Keep the saw head close to the ground and tucked into machine to provide quick support if required.
- Ensure the felling plan enables a safe skidding / hoe-chucking strategy. Place bunched timber at 10 o'clock to 2 o'clock position, preferably on the control side of ground skidders (if being used). In difficult areas, place felled trees so the skidder or hoe-chucker can access bunches from less steep or risky areas.

Feller-buncher - Additional Controls

- Use a machine with a tilting cab or self-leveling house.
- Use an intermittent (or cold) saw for maximum control and operational flexibility.
- Use feller-buncher modified for better stability (e.g. extended tracks, counterweights, etc.)
- Use a felling head that rotates at the wrist to afford accurate grappling of the tree.
- Reduce bunch size; specify target bunch size in plan.
- Minimize stump heights; consider "shaving" stumps.
- Place felled timber as close as possible to ground level.

Skidder / Forwarder - Standard Practices

- Regularly check your work area for hazards (unstable stems, danger trees, rocks dislodged during felling, changing weather) and work with your supervisor to develop a plan that addresses hazards.
- Confirm proper tire inflation and condition. Use chains with lugs on front wheels, or all wheels. Frequently inspect chains for integrity, condition and tightness.
- Work straight up and down slopes only, never travel across side hill. It may be necessary to locate and use a circle route to access timber on steep slopes.
- Use lower gears and reduce speeds when climbing or descending slopes.
- Avoid travel over stumps, boulders, rocky outcrops and other obstacles.
- Do not attempt to turn around on a steep slope; use a bench that is adequately flat and wide.
- Back straight up steep slopes with grapple outstretched and as close to the ground as possible. Avoid backing up steep slopes when visibility is inadequate.
- Carry the blade high enough to clear stumps and obstructions while skidding, but low enough to provide a quick response for additional stability.
- Grapple skidder: To avoid loss of steering control due to logs binding on the apron, keep logs close to the apron but not touching it. Adjust grapple position (i.e. slightly increase clearance between butts and apron) prior to making sharp turns and steering around obstacles.
- Line skidder: Travel down slope keeping the logs tight to the apron. Slightly reduce line tension to provide clearance between butts and apron prior to making sharp turns and steering around obstacles.
- Avoid winching a turn of logs at an angle to the machine.
- Forwarder: Ensure loads are close to the machine before initiating lift; avoid long reaches.

Skidder / Forwarder - Additional Controls

- Use stability-improving options (e.g. wheel spacers, wide 'floatation' tires).
- Consider using tracked machines to skid (e.g. clambunk with tracks, KMC, D5 / 527-swing grapple, etc.) or purpose-built machines (e.g. TigerCat 635C).
- Ensure tracked machines have tracks that are in good condition and outfitted to provide superior traction (e.g. 2-3" picks on every 2nd grouser).
- Engage differential lock (if equipped) for added traction travelling uphill but disengage when descending or turning as steering will not respond properly when differential is locked.
- Do not attempt to skid from areas where it is unsafe to do so. Mark on map / notify supervisor for attention by alternate method(s).
- Limit exposure to skidding on steep slopes that continue for more than 50 metres.
- Equip line skidders with adequate mainline and chokers to reach trees felled on steep ground from area less than 35% or designated skid trail.
- Make smaller turns to avoid over-loading or over-balancing the machine.
- Carry turns as low to the ground as possible without hanging up on stumps and rocks.
- Where provided, skid on identified (marked) or designated bladed trails.
- Skid Trail Construction - Trails must be constructed of stable material and be adequately wide to accommodate the intended machine (e.g. 1.5 times machine width). Trail grades, including switchbacks should not exceed 30% continuous grade except for short pitches.

Hoe-chucking - Standard Practices

- Regularly check your immediate work area for hazards (unstable stems, danger trees, rocks dislodged during felling, changing weather) and work with your supervisor to develop a plan that addresses hazards.
- Ensure tracked machines have tracks that are in good condition and outfitted to provide superior traction (e.g. 2-3" picks on every 2nd grouser).
- Operate hoe-chucker "straight up" and "straight down" the steep slope. Take advantage of natural benches or side-slope breaks as preferred stable work locations.
- Swing wood close to the ground so that the log and/or boom can be used to stabilize the machine.
- Swing the loaded grapple close to the machine; avoid extending the boom any further than necessary.
- Move debris accumulations (broken stems, tops, branches that may be obscuring rocks or depressions) so you can see the ground you intend to travel over.
- Avoid walking over stumps, boulders, rocky outcrops or other obstacles.
- Ensure the machine is in a stable position before swinging wood.

Hoe-chucking - Additional Controls

- Consider using tandem or multiple machines (to reduce total machine travel on steep slopes, and to provide continuous visual contact between operators re check-in).
- Plan and implement narrower swing corridors – as slope steepness increases, swing corridor width narrow.
- Reduce the amount of wood in each swing (i.e. avoid swinging multiple stems).
- Use trails as provided; ask for additional trails where they are required.
- Think about the next phase; build stable decks in locations that are accessible to the next swing, or beside a spot where the processor can operate with stability.

Processor Standard Practices

- Operators will frequently check their immediate work areas for hazards (unstable felled stems, danger trees, rocks dislodged during felling, changing weather) and work with their supervisor to develop a plan that addresses hazards.
- Operate aligned with the slope (“straight up” and “straight down”); avoid operating across steep slopes.
- Use trails as provided; ask for additional trails where required.
- Plan and implement narrower work corridors – as slope steepness increases, reducing boom extension to maintain stability will reduce the work corridor.
- Swing / process logs close to the ground so that the boom and/or log can be used to stabilize the machine, if sudden instability occurs.
- Avoid walking over stumps, boulders, rocky outcrops or other obstacles.
- Move debris accumulations (broken stems, tops, branches that may be obscuring rocks or depressions) so you can see the ground you intend to travel over.
- Ensure the machine is stable before initiating processing.
- Think about the next operational phase; build stable decks in locations that are accessible to the loader.

Part 3
Steep Slope Planning and Operational Responsibilities

Owners / Licensees / Project Proponents

The forestry planning process initiates collection of key information and development of plans that will facilitate safe, productive harvest operations. In order to address business objectives or as required under various regulations, owners / licensees / proponents typically conduct (or direct) initial harvest planning. They usually have access to information resources (maps, assessments) and experienced personnel necessary to identify areas that have steep slopes and related hazards. As a result, they are well equipped to compile necessary information into a comprehensive package and communicate that information to subsequent phases (e.g. layout, contractors, etc.).

Regulations confer responsibilities to owners with respect to identifying workplace conditions where there is a known or reasonably foreseeable risk to workers, and with respect to providing employers or prime contractors with information necessary to identify and eliminate or control workplace hazards.

Owners / license holders / project proponents should undertake the steps below.

Communicate basic steep slope hazard information to prime contractor / employers

- Early in the planning phase, develop a map that identifies areas that have slopes >35% and where mechanical operations are planned. Use topographic information (e.g. TRIM2 maps, air photos, LiDAR); if reliable topographic information is not available, use field measurements (e.g. lay out crew using clinometer). Communicate this information to the site supervisor / prime contractor, as the case may be, for their further application of the steep slope hazard assessment / plan process.

Best Practices

- Early in the planning phase, develop a preliminary map that identifies areas having slopes >35% and that are planned for mechanical operations; use suitable topographic information (e.g. TRIM2, air photos, LiDAR).
- Use experienced lay out crews with knowledge of the steep slope hazard assessment process; consider including a person qualified to conduct an initial hazard assessment. Provide them with the preliminary operational map, have them more accurately map steep slope areas, and collect / record site attribute information (as per assessment form).
- Using a suitable mapping scale (1:5,000 is the preferred, but greater detail maps may be required to adequately convey information), construct an operational map that identifies areas by slope category (e.g. <35%, 35-50%, >50% and NO GO areas, OR <40%, 40-50%, >50% and NO GO areas).
- Conduct required assessments (e.g. Terrain Stability Field Assessment, gully, riparian assessments) and collect other supporting information (e.g. cruising, Silviculture Prescription, etc.).
- Incorporate relevant assessment information into an initial harvest plan.
- **Communicate** this information to the site supervisor / prime contractor / employer, as the case may be, for their further application to the steep slope hazard assessment / plan process.
- Periodically review contractor steep slope hazard assessment and harvest practices as necessary to confirm they are performing to expectations / requirements.

Employers / Contractors

Given the diversity of arrangements under which forest harvesting occurs in BC, it is difficult to strictly assign a set of duties to each given party. In some cases, the owner is also the employer, and they may delegate specific duties to a supervisor. Often, the contractor *is* the employer; the company owner might be the supervisor, or they may hire a supervisor. With that in mind, the compilation below identifies planning, operational and administrative safe work practices that are necessary for successful steep slope mechanical operations, and which are the responsibilities of a *typical* logging company contracting to a licensee.

Planning

- Receive, review and consider preliminary steep slope hazard information received from the site owner.
- Conduct (or direct a qualified person to conduct) a thorough field review using the steep slope hazard assessment tool and resulting in specific **steep slope procedures** that are practical and achievable.
  OR
  If the employer receives a completed steep slope hazard assessment and/or procedures (e.g. from the site owner), verify information is correct, accurately mapped and operationally feasible.
- Confirm that mechanical harvesting is the "right" approach. Where the employer cannot reasonably assure stability of machines that will be engaged in mechanical harvesting on that block, work with the owner to develop an alternate harvest plan.
- Conduct these steps far enough in advance of operations that any necessary amendments can be achieved.
- Ensure the plan considers all machine stability variables (e.g. as identified in the risk assessment) as each relates to a regulatory requirement or best practice, and that maps show key site information.
- Build a plan in which operations in one phase compliment operations in the next phase.
- Before commencing operations, update steep slope plan maps to show any previously unidentified hazards and the resulting changes to the plan.
- Identify the manufacturer's maximum slope operating stability limit for logging equipment (if any is known or provided); review the manufacturer's specifications for machine capabilities (lift capacity, reach, etc.).
- Ensure any specific modifications are designed / approved by an engineer.
- Engage and assign competent, experienced operators with a safe work record.
- Assign qualified site supervisor(s). Explain expectations regarding the nature and frequency of field supervision; identify them in the pre-work. Remind supervisors of their responsibility to correct operator deviations from plan / procedures.
- Establish procedures to deal with equipment breakdown, difficult or precarious situations, and upset conditions. General measures likely exist in the employer's emergency response procedure, but customize these to address site-specific steep slope conditions; discuss them at the pre-work meeting. See Appendix 3 - Steps for Dealing with Breakdowns & Emergencies for a few possible steps.
- Instruct the supervisor(s) on procedures to manage previously unidentified risks and changing conditions, and designate man-check frequency, mandatory operator rests, etc.

Operational

- Before allowing operators to begin operations, field review the steep slope sites with the site specific work procedures. Operators should participate in the field review. Together, they should verify slope percentages with a clinometer, and that harvesting / extraction methods identified on the plan are appropriate.
- Verify specified equipment is on-site and suitably equipped / configured as per the site specific procedures.
- Confirm designated operator (i.e. with necessary steep slope training, experience) is on site.
- Mark significant hazard areas in the field ahead of operations to warn operators against inadvertently venturing onto high risk areas (e.g. during nightshift operations or poor visibility). Identify the marking system used in the plan and on maps.
- Before work commences, hold a pre-work meeting to review the steep slope harvesting procedures and maps with the operator(s), including
    - Orient operators to maps (direction, block boundaries, roads, landmarks, etc.)
    - Review NO GO zones, site-specific hazards (field and map), wildlife tree patches, leave patches / trees, riparian zones, field marking strategy, etc.
    - Identify starting point and schedule of operations.
    - Discuss how to deal with previously un-identified hazards and changing conditions.
    - Discuss frequency of supervisor visits.
    - Identify the man-check frequency appropriate to risks, check-in person (supervisor or other worker on site) and the contact method (e.g. 2-way radio, cell phone, etc.).
    - Identify the frequency of mandatory operator rests.
    - Complete a thorough machine inspection; ensure fluids are full and maintenance and servicing is current.
    - Confirm operators understand when to call for assistance and when to suspend work (e.g. if they are unclear on upcoming terrain or timber, or unsure they are able to complete operations safely, stop the machine in a safe location and get clarification from the supervisor before proceeding).
    - Sign-off steep slope plan.
- Logging sites are *dynamic* workplaces. Changing human, environmental and mechanical conditions create different hazards and risk levels. These factors are inter-related. For example, risks associated with duration of exposure depend on operator competencies, state of mind (e.g. focused on work versus fatigued or distracted by personal issues), site complexity and daily weather. The contractor is responsible to identify changing conditions (e.g. wind storm, decreased operator alertness, etc.) and apply sound judgment to re-evaluate hazards and determine what different steps or controls are necessary to assure continued machine stability and safe operations.
- Use effective regular communication (pre-works, tailgate meetings) between operators, supervisors and other workers to discuss work progress, effectiveness of implemented controls, and steps to manage unforeseen hazards / changing conditions.

Administrative

- Document pre-work, field reviews, man-check system, supervisor field checks and other actions in an appropriate form (e.g. via notes in supervisor journal).
- Supervisor(s) must observe operators working to confirm competency and to correct any work method deficiencies or failures to follow the steep slope plan.
- Maintain a copy of the complete steep slope plan with the site supervisor and at a location readily accessible to other workers.
- Maintain operator and supervisor experience and qualifications records (see sample forms in Part 4 below).
- Develop and communicate procedures specific to steep slope works (e.g. providing assistance in the event of a disabled or upset machine); link those procedures to the Emergency Response Plan for that site.

Employees / Operators

Machine operators are key links in every steep slope harvesting plan. They are most aware of changing conditions and situations, most likely to identify previously unrecognized hazards, have the best understanding of equipment capabilities, and are most likely to be directly impacted by machine instability. The following describes responsibilities that reside with the operator(s) conducting the work.

Operators must

- review the steep slope harvesting procedures and map with the supervisor and/or the qualified person that conducted the risk assessment; have a copy of the harvest plan and map in the machine at all times.
- self-assess to confirm they are fit, able and prepared to complete the work.
- ensure they are fully trained and competent to operate the machine they are assigned, and capable of executing procedures and practices described in the plan.
- conduct and document daily equipment inspections, including a functional check of the equipment's escape hatch(s).
- know the functions and limitations of their machine. They must be able to recognize signs that indicate the machine may not be operating safely (e.g. poor performance, intermittent functions, hydraulic leaks, dull blades, high temperature, etc.

Operators are responsible to refuse work they feel is unsafe. If they feel they cannot implement the plan safely, the operator must stop work, and consult the supervisor to develop an alternate safe plan before working again.

Part 4
Support Forms and Documents

Forms Overview / Instructions
Use these form "as-is" or modify them to suit their operations / meeting format.

Operator Experience / Qualification Record
Employers are required to confirm that operators are adequately trained / experienced to conduct work assigned to them. They are also required to confirm competency by observing the worker competently completing assigned work.

Most employers will have an existing process to document employee training and experience. This form can be used to document other relevant training and experience to support introduction of a new operator to steep slope operations as well as the dates (frequency increased) the supervisor observes the operator competently completing assigned duties. It also can be used to document qualifications / competencies of operators that are qualified for all steep slope operations. For experienced operators, employers might choose to complete this form once, review / update it annually, and confirm it at steep slope operations pre-works.

Supervisor Experience / Qualification Record
This is a similar process to above, but intended for documenting experience and qualifications for supervising steep slope operations. If the contractor and supervisor is the same person, the contractor must record his / her supervisory experience, and date and sign their qualifications. The prime contractor or Licensee should check and confirm this information.

Steps for Dealing with Breakdowns & Emergencies
While an employer's Emergency Response Plan will typically include some emergency procedures, this page provides specific steps / practices operators should observe in the event of machine breakdown, precarious position or upset condition.

WorkSafeBC Steep Slope Logging Checklist

WorkSafeBC has developed a checklist to aid Occupational Safety Officers in their inspection of steep slope logging operations. This checklist is included as an appendix to help logging contractors assess their operations for compliance with the regulations. In particular the responsibilities section of the checklist is valuable to review.

Appendix 1: Operator Experience / Qualification Record

Operator Name: _____ Date: _____

Training completed, Certificates Held: _____

_____

Machine (Type, Model, Configuration)	*Experience (# of Years or Months)*	*Timber Type & Size*	*Slope Steepness*	*Operator Competency on Steep Slopes Observed On Date*	*Supervisor Signature*

Operator Name: _____ Date: _____

Training completed, Certificates Held: _____

_____

Machine (Type, Model, Configuration)	*Experience (# of Years or Months)*	*Timber Type & Size*	*Slope Steepness*	*Operator Competency on Steep Slopes Observed On Date*	*Supervisor Signature*

Use one line for each type of equipment. Include all relevant mechanical harvesting experience. The contractor or site supervisor is responsible to initially complete this experience record as a means of documenting suitable operator experience before assigning work on steep slopes. The employer also must to ensure a supervisor periodically observes the operator competently applying sound methods to implement the work plan, and to identify incorrect work habits and take necessary steps to correct deficiencies.

Appendix 2: Supervisor Experience / Qualification Record

Operator Name: _____ Date: _____

Training completed, Certificates Held: _____

_____

Forestry Mechanical Equipment Experience (# of Yrs / Months)	*Experience Supervising Mechanical Operations(# of Yrs / Months)*	*Experience Supervising Steep Slope Operations(# of Yrs / Months)*	*Qualified to assess hazards and create steep slope plans as of:*	*Contractor signature*

Operator Name: _____ Date: _____

Training completed, Certificates Held: _____

_____

Forestry Mechanical Equipment Experience (# of Yrs / Months)	*Experience Supervising Mechanical Operations(# of Yrs / Months)*	*Experience Supervising Steep Slope Operations(# of Yrs / Months)*	*Qualified to assess hazards and create steep slope plans as of:*	*Contractor signature*

Appendix 3: Steps for Dealing with Breakdowns & Emergencies

In the event of equipment breakdown, precarious situations and upset conditions, always:

Stay calm – To respond effectively you need to proceed rationally. Don't jeopardize your own safety. Your example can influence others and thereby aid the emergency response.

Assess the situation – What is the problem or emergency? What has happened, and what will continue to happen if no action is taken? Identify the cause that must be controlled to eliminate immediate, ongoing, or further danger. What are the possible courses of action? Which ones have the greatest likelihood of success? What are the risks and dangers associated with those actions?

Next

- Establish radio contact with your supervisor or on-site contact.
- Identify your location; explain the situation, request assistance.
- Await their recommendations / direction. Do as they say.

Equipment Breakdown on Steep Slopes

Completing repairs while a machine is on a steep slope poses significant hazards and risks. If it is not possible to move the machine to stable location, take the following steps.

- Before exiting, ensure the machine is stable. If the machine feels unstable, and it is safe to do so, lower boom / blade / attachments and release loads to increase stability.
- Survey the area for hazards – danger trees, debris, partially cut trees, unstable logs, etc.
- Engage and confirm lockout procedures before undertaking any checks or repairs.
- Conduct only those repairs necessary to allow moving the machine to a flat site.

Precarious Positions – Nearly Upset Condition

- Evaluate the situation. Will releasing the load improve or reduce machine stability? Will raising or lowering the blade / boom / attachments increase or decrease the likelihood of incurring a rollover?
- Conduct any / all movements and operate controls smoothly and precisely.
- Stay in the cab – exiting the cab may upset the balance, or you may injure yourself as you jump, or inadvertently to a location onto which the unbalanced machine then rolls.
- If your assessment determines the least risk option is to exit the cab, first survey the area for hazards – uneven ground, debris, unstable logs, etc. Communicate your plan before exiting.

Machine in Upset Condition

- Stay in the cab. Heavy equipment sometimes comes to rest in delicately balanced conditions. Getting out may upset that balance and expose you to further harm.
- Secure yourself against further injury, should further machine movement occur.
- Wait for assistance to arrive.
- If your assessment rationally determines that further machine movement is likely and will result in greater injury to you, survey the area for hazards before exiting.

Appendix 4: WorkSafeBC Steep Slope Logging Checklist

Steep slope logging checklist

Date _____ Location _____

Firm/employer _____ Cutting permit _____

Licensee/owner _____ Owner/operator _____

When it comes to creating a safe workplace, we all have responsibilities. Safety requires a group effort and cooperation from the whole team, including owners, employers, supervisors and workers.

Below is a safety checklist to use when assessing compliance with the Occupational Health and Safety Regulation (OHSR) and the *Workers Compensation Act* (the Act) at steep slope operations.

Owner responsibilities — the owner must:			
○ Yes	○ No	○ n/a	119(b) Provide all of the known information to the prime contractor so they can eliminate or control steep slope hazards (e.g., maps with slopes and related information).
○	○	○	26.2(1) Conduct and plan for steep slope operations and acceptable safe work procedures that are consistent with the OHSR.
○	○	○	26.2(1) Ensure steep slope plans have been reviewed and acknowledged, and that a system is in place to ensure compliance.
○	○	○	26.2(3)(a) Identify conditions and activities that are associated with known or foreseeable risks to workers.
○	○	○	26.2(3)(b) and (c) Conduct and document advance planning for the work.
Prime contractor responsibilities — the prime contractor must			
○ Yes	○ No	○ n/a	118(2)(a) and (b) Establish and maintain a system to ensure compliance with the Act and OHSR, and coordinate health and safety at the workplace.
○	○	○	26.2(2) Conduct and plan for steep slope operations that are consistent and compliant with the OHSR.
○	○	○	26.2(2) Ensure acceptable safe work procedures are in place that meet guideline requirements.
○	○	○	26.2(3)(a) Identify conditions and activities that are associated with known or foreseeable risks to workers.
○	○	○	26.2(3)(b) and (c) Ensure advance planning has been conducted and documented for the work.
Employer responsibilities — the employer must:			
○ Yes	○ No	○ n/a	115(1)(a) Ensure the health and safety of your workers as well as the other workers onsite.
○	○	○	115(2)(e) and 26.3(1) Adequately instruct, train, and supervise workers in steep slope operations.
Supervisor responsibilities — the supervisor must:			
○	○	○	117(1)(a) Actively supervise and monitor steep slope operations
○	○	○	16.6 Not knowingly allow a worker to operate mobile equipment in a way that could create an undue hazard.
Operator (worker) responsibilities — the operator (worker) must			
○ Yes	○ No	○ n/a	116(2)(a) Follow acceptable safe work procedures.
○	○	○	116(2)(e) (ii) Report any hazards encountered to the supervisor.
○	○	○	3.12(1) Stop work if the plan uncovers any high risk issues (e.g., the machine slips down the hill or equipment is being pulled with attachments).
○	○	○	16.5 Operate the mobile equipment safely.

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The use of rubber-tired skidders			
○ Yes	○ No	○ n/a	26.16(2) If the manufacturer's maximum operating limit is known, ensure the equipment is operated within that limit.
○	○	○	26.16(3)(b) If the manufacturer's limit is unknown, ensure the equipment is not operating beyond 35 percent.
If the limits are being exceeded, ensure:			
○	○	○	26.16(4)(a) A risk assessment has been carried out by a qualified person and
○	○	○	26.16(4)(b) Acceptable, written safe work practices regarding equipment stability are developed and followed (see Guideline 26.16).
The use of tracked equipment			
○ Yes	○ No	○ n/a	26.16(2) If the manufacturer's maximum operating limit is known, ensure the equipment is operated within that limit.
○	○	○	26.16(3)(b) If manufacturer's limit is unknown, ensure the equipment is not operating beyond 40 percent.
If the limits are being exceeded, ensure:			
○	○	○	26.16(4)(a) A risk assessment has been carried out by a qualified person and
○	○	○	26.16(4)(b) Acceptable, written safe work practices regarding equipment stability are developed and followed (see Guideline 26.16).
The use of other steep slope equipment			
○ Yes	○ No	○ n/a	26.16(2) If the manufacturer's maximum operating limit is known, ensure the equipment is operated within that limit.
○	○	○	26.16(3)(b) If manufacturer's limit is unknown, ensure the equipment is not operating beyond 50 percent.
If the limits are being exceeded, ensure:			
○	○	○	26.16(4)(a) A risk assessment has been carried out by a qualified person and
○	○	○	26.16(4)(b) Acceptable, written safe work practices regarding equipment stability are developed and followed (see Guideline 26.16).
Risk assessment and plan (for operations exceeding limits) — the employer must:			
○ Yes	○ No	○ n/a	26.16(4)(a) Ensure the risk assessment has been completed by a qualified person.
○	○	○	26.16(4)(b) Ensure acceptable safe work procedures regarding equipment stability are written, in place, and followed.
○	○	○	26.2(4)(b) If there is evidence the plan is not working (e.g., track slippage or the machine pulling itself up the hill), amend the plan as appropriate for the risk, and/or stop work if warranted.
○	○	○	26.3(1) Ensure workers are trained in the safe work procedures.
Emergency response — the employer must:			
○ Yes	○ No	○ n/a	3.17 Have adequate first aid procedures in place for the site.
○	○	○	4.21 Have appropriate procedures for workers working alone or in isolation.
○	○	○	26.2 Include in their planning provisions for emergency response.
○	○	○	4.14(3) Test and document their emergency response plan.