G4 GOOD PRACTICE FOR WILDING CONIFER CONTROL

NATIONAL WILDING CONIFER CONTROL PROGRAMME

POST CONTROL AUDITING (PCA) FOR GROUND CONTROL

VERSION 1: NOVEMBER 2024

The post control audit guide is to assess the quality of operational ground control work in the National Wilding Conifer Control Programme (NWCCP).

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Front cover: Tekapo West Ground Control (Photograph: Adam Ross, BNZ)

ABOUT THIS DOCUMENT

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VERSION CONTROL

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BACKGROUND

The auditing protocol is to assess the quality and efficacy of control work. It focuses on two ground-control methods: "cut and stump", where a tree is cut down and herbicide is pasted onto the stump, and "drill and fill", where holes are drilled into the base of trees and herbicide is injected into the holes. The audit involves carrying out plot-based assessments along transects and recording information about the number of trees that have been successfully controlled, incompletely controlled, or missed.

Ideally audit should be carried out (by an independent auditor) as soon as ground control activity has been completed. This is to enable the auditor to identify visible signs (e.g. herbicide stain on stumps from cut and stump control and drill holes from drill and fill control operation) of ground control activities soon after the control activity has been completed rather than later.

The protocol specifies how this work should be carried out, including:

- Transect layout and establishment procedures.
    - Generate transect starting points.
    - Locating the start of the transect
    - Fixing the location of the transect and consecutive plot centres.
    - Transect layout.
    - Plot establishment.
    - Plot size and boundary.
    - Wilding tree measurements within plots.
    - Vegetation cover.
- Metadata requirements
- Data collection sheets

1. TRANSECT LAYOUT AND ESTABLISHMENT PROCEDURES

1.1 GENERATING THE STARTING POINTS FOR AUDIT TRANSECTS

The NWCCP uses the control area polygon, submitted to the WCIS by the contractor that conducted the control, to assign randomised starting points based on a national grid within the audit area[1] . An intermediate step is undertaken by the NWCCP to identify the spatial heterogeneity of control activity across control areas (e.g. based on GPS track records supplied) to ensure that 70% of the transects cover areas with high control activity and 30% cover areas with lower control activity (stratified random sampling). The starting points generated that way for a specific control audit will be supplied to the auditor.

The number of transects is area-dependent and Table 1 provides guidance on how many transects can be expected to be assessed.

Table 1

APPROX. CONTROL AREA	NUMBER OF TRANSECTS (NO OF PLOTS)
< 25 ha	Up to 3 (30)
25-50 ha	Up to 6 (60)
50-75 ha	Up to 8 (80)
75-100 ha	Up to 10 (100)
≥ 100 ha	10 (100) plus 1 transect for every additional 25 ha

1.2 LOCATING THE STARTING POINT OF AN AUDIT TRANSECT

Random starting points of the transects will be provided to the auditor before the audit starts. To locate and position the starting point use the following approach:

1. Use a standard GPS device with the loaded coordinates (e.g., Garmin Map 60CXS or better) to navigate towards the transect starting point. Ensure that the GPS uses the correct magnetic declination[2] for the area and the compass is calibrated.
2. When within approximately 10m of the transect starting point, use the compass bearing and distance given by the GPS to navigate to the starting point (which is the centre of the first plot).
3. Confirm that the location of the point on the ground matches the position on an aerial photograph (if provided).

Note: It is important that the starting point of the transect (and therefore the centre of the first plot of the transect) is determined by following the compass bearing and distance from the initial GPS location when 10m away. This is because the accuracy with which a GPS receiver can locate a specific point decrease as the point is reached.

[1]This is done independently to ensure e.g. non-bias.

[2] This is relevant when using a compass for the aim towards the starting point so that the GPS provides the correct bearing and for laying out the transect direction.

1.3 FIXING THE LOCATION OF THE START OF THE TRANSECT AND PLOT CENTRES

Once the start of the transect or the centre of a plot along the transect has been identified, a fixed position will need to be recorded using the 'average' function on the GPS.

1. Position your GPS unit exactly over the first plot centre (also the starting point of the transect)
2. Record the location for at least one minute using the averaging function on your GPS.
3. When using a high-grade GPS (e.g. Trimble) with recording function by time (e.g. every 1-2 seconds), record at least 50 recordings.
4. Long term readings can be done by leaving the unit recording at the centre point while other measurements are completed.
5. GPS coordinates need to be saved with the naming convention control-polygon-ID transect-number plot-number. The control-polygon-ID will be provided to auditors by the management of the control area before auditing starts.

1.4 TRANSECT LAYOUT

The general form of the transect is a straight line following true north or true south with a total length of 270m with measurement plots installed every 30m (10 measurement plots in total). Plot transects will be established from the transect starting point using the following steps:

1. From the starting point determine true north and south from the starting point, accounting for the local declination between true north and magnetic north (e.g. 23 degrees east)
2. Determine whether the position of the transect starting point is closest to the north or south border of the control area; the bearing of the transect will follow the opposite direction to the nearest border (i.e., if closest to the north border, the transect will follow true south). Determining the direction of the transect can be done before heading into the field by consulting a map showing the transect starting points and the polygon of the controlled area.

Deviations from a straight line transect might be necessary due to inaccessibility (e.g., cliffs or other features that can't be crossed safely) or if a straight transect would leave the control area. In these cases, the following steps need to be taken:

1. At each transect plot determine if the 30 m towards the next plot is accessible and remains within the controlled area
2. If obstructions or a boundary crossing is present, proceed with the transect towards the true east, perpendicular to the original direction of the transect. If travel towards the east is not possible, due to obstructions or an area boundary, the transect should instead follow towards the true west.
3. At every transect plot re-assess the obstruction or boundary situation towards the original transect bearing (true north or south). Where possible, proceed with the transect along its original bearing. See Figure 1 for examples.

2. PLOT ESTABLISHMENT AND MEASUREMENTS

2.1 PLOT ESTABLISHMENT

- Measurement plots need to be installed at the starting point of each transect and every consecutive 30m along the transect.
- Distance between plots along a transect need to be measured along the determined bearing of the transect.
- Distance should be measured from the plot centre to the next plot centre point using a straight tape, running line or the distance function of a Vertex or similar field instrument.

Figure 1. Map showing possible transect lines.

2.2 PLOT AND BOUNDARY

- Each individual measurement plot will have a circular form, with a horizontal[3] radius of 5.64m and a horizontal area of 100 m^2 for control sites with sparsely distributed trees and a horizontal radius of 2.82m and a horizontal area of 25 m^2 for control sites with densely[4] distributed trees.
- Place a metal peg in the centre of the plot so it can be relocated temporarily (< 2-3 years) if needed (e.g. for evidence and learning purposes).
- To determine the area of the plot, a tape or string with the correct length (correcting for slope) matching the radius (2.82m or 5.64m), should be fixed to the centre peg (or to a pole at the centre).
- Ensure that the tape is horizontal (i.e. the tape has a slope of zero from end to end) when identifying the boundary.
- For drill and fill plots, include standing trees on the plot boundary when ≥ 50% of the tree stem (at a height of 1.4m above ground), is inside the plot area. For cut stump plots, include stumps when ≥ 50% of the stump is inside the plot area (Fig.2).

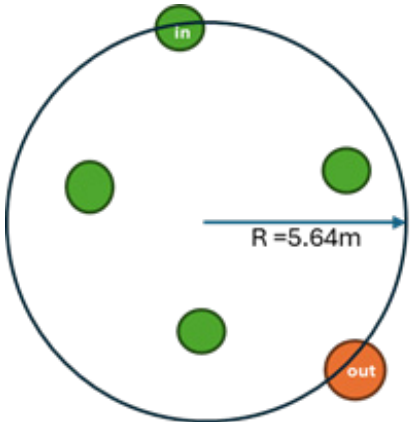

Figure 2. 100m^2 circular plot with stems (circles) of drill and filled trees meeting the criteria being inside plot (green) and outside plot (red).

[3]Radius need to be measured along the right angle to the vertical and NOT along the ground to ensure sampling area (always measured horizontally) stays the same for all plots.
[4]Dense - defined as: visually more than 30 trees in the 100m^2 plot can be counted.

2.3 WILDING TREE MEASUREMENTS – DRILL AND FILL PLOTS

All wilding conifer trees (dead and live) inside the plot need to be recorded and measured. Note – trees/ stumps that have been cut rather than drilled should not be counted when assessing drill and fill.

1. Record data according to the plot sheet example provided (Appendix B).

2. Take a photo of the first controlled tree in the plot (working from true north and moving clockwise) to capture the quality of the control technique. Attach a tag with the transect number and plot number to the tree temporarily before taking the photo, to support plot identification. Measure the DBH (in cm) of the photographed tree, count the number of drilled holes, and note whether the holes are evenly spaced around the trunk and record on plot sheet.

3. Starting from true north and moving clockwise, count all individual wilding conifers grouped by species and status (dead/ control failure / missed) and by height class. A control failure is a tree that has been drilled but has not completely died (i.e. there are some alive sections of foliage). A missed tree is one that has not been drilled. To determine height class, measure the height of each individual tree with a measurement pole or tape to determine the height class and count the tree in the appropriate class (see Table 2).

Table 2

HEIGHT CLASS	HEIGHT-LIMITS
Tier 1a	< 0.1 m
Tier 1	<0.5 m
Tier 2	≥ 0.5-1.3 m
Tier 3	≥ 1.3 -2.5 m
Tier 4	≥2.5 – 5 m
Tier 5	≥ 5m

For each wilding species, record the number of live trees and control failure trees that are coning.

2.4 WILDING TREE MEASUREMENT – CUT STUMP PLOTS

All wilding conifer trees (dead and alive)[5] and cut stumps inside the plot need to be recorded. Note – trees that have been drilled rather than cut should not be counted when assessing cut stump plots[6] (except when the audit specifies auditing both control methods).

1. Record data according to the plot sheet example provided (Appendix D).

2. Take a photo of the first controlled stump (working from true north and moving clockwise) in each plot to capture the quality of the control technique. Attach a tag with the transect number and plot number to the stump before taking the photo, to support plot identification.

3. Starting from true north and moving clockwise, count all individual cut stumps that are fully controlled and all that are a control failure. A cut stump has control failure if:
   a. Green needles remain on the stump and herbicide has not been applied to cover the cambium layer of the stump, (note that depending on time audit is done after control operation, sign of herbicide on the stump might not be visible or obvious), or
   b. The cut stem is still partially attached to the stump, or
   c. Branches have not been cut from the stump and pasted, or
   d. The stump has not been cut close to the ground (ideally no higher than 10 cm considering the terrain as specified in the Cut and Stump GPG)

4. Count all missed (uncut) trees grouped by wilding conifer species and height class (Table 2). To determine height class, measure the height of each individual tree with a measurement pole or tape and record it as the appropriate class (see Table 2). For each species, record the number of missed trees that are coning.

[5] This includes all wilding conifer trees including those that were not drilled (e.g. smaller trees that could not be drilled but e.g should have been pulled)

[6] As with drill and fill plot assessments all wilding trees including those not cut need to be included (e.g. smaller

2.5 VEGETATION COVER

In every plot, assess the dominant vegetation cover for the plot area and record one of the following classes:

- bare ground
- grass (non-grazing)
- grass (active livestock grazing)
- shrub
- forest exotic
- forest indigenous

3. METADATA

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For each transect and plot, the metadata needs to include:

- The control-polygon-ID transect-number plot-number code, to link GPS data with field records and any useful comments. See section 1.2.5.

The initials of the auditor, date of the audit and any further notes that might be required e.g., "transect direction changes to east at plot x".

3.1 DATA MANAGEMENT

Data collected should be entered into an excel sheet and sent to the project manager. Raw data sheet should also be attached and sent along with the excel sheet.

APPENDIX A: METADATA SHEET FOR EACH TRANSECT AND PLOT

Funding agency of the audit:	
Contact person:	
Executer/Contractor for audit:	
Auditor (initials):	
Date of the audit:	
Location:	
To link GPS data:	
Control-polygon-ID:	
Transect ID:	
Plot-ID code:	
Ground Control Type:	
General notes on audit plot:	

APPENDIX B: DRILL AND FILL PLOT EXAMPLE SHEET

Control polygon ID: *A1*		Transect no.: *3*		Plot no.: *5*	Control: *Drill and fill*	1st tree photo taken? [X] DBH (cm): *80* No. holes: *6* Holes evenly spaced? *Y* / N		
	Transect / plot comments: *Changed to east at plot 3*					Vegetation cover: *Grass (non-grazing)*		
Species	Status	Tier 1a	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5	# coning
Pinus contorta	Dead				*III*	*IIII*	*II*	*NA*
	Control failure				*III*			*I*
	Missed	*~~IIII~~ IIII*		*~~IIII~~ II*	*I*			*II*
Pseudotsuga menziesii	Dead				*III*	*III*		*NA*
	Control failure				*IIII*	*II*		*II*
	Missed	*II*		*III*				
	Dead							*NA*
	Control failure							
	Missed							
	Dead							*NA*
	Control failure							
	Missed							
Notes on control e.g. holes irregularly spaced; too many/ few holes; incorrect angle etc:				*The Tier 3 Pinus contorta trees with failed control did not have enough holes drilled into it and they were drilled at an incorrect angle.*				

APPENDIX C: DRILL AND FILL PLOT RECORDING SHEET

Control polygon ID:		Transect no.:		Plot no.:	Control: Drill and fill	1st tree photo taken? [ ] DBH (cm): No. holes: Holes evenly spaced? Y / N		
	Transect / plot comments:					Vegetation cover:		
Species	Status	Tier 1a	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5	# coning
Pinus contorta	Dead							
	Control failure							
	Missed							
Pseudotsuga menziesii	Dead							
	Control failure							
	Missed							
	Dead							
	Control failure							
	Missed							
	Dead							
	Control failure							
	Missed							
Notes on control e.g. holes irregularly spaced; too many/ few holes; incorrect angle etc:								

APPENDIX D: CUT STUMP PLOT EXAMPLE SHEET

Control polygon ID: *A1*	Transect no.: *3*	Plot no.: *5*	Control: *Cut stump*	Photo taken? [X]
Transect / plot comments: *Changed to east at plot 3*				Vegetation cover: *Grass active grazing*
No. controlled trees: ~~IIII IIII IIII IIII IIII IIII IIII~~ II				*No. control failures:* ~~IIII~~ I

Species of missed trees	Missed trees per height class						No. of missed coning trees
	Tier 1a	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5	
Pinus contorta	II	IIII				II	
Pseudotsuga menziesii	I	~~IIII~~			II		
Notes on control e.g. whole stump pasted; branches not removed; etc			*Control failure – poor herbicide application. One stump did not have branches removed*				

APPENDIX E: CUT STUMP PLOT RECORDING SHEET

Control polygon ID:	Transect no.:	Plot no.:	Control: *Cut stump*	Photo taken? [ ]
Transect / plot comments:				Vegetation cover:
No. controlled trees:				*No. control failures:*

Species of missed trees	Missed trees per height class						No. of missed coning trees
	Tier 1a	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5	
Notes on control e.g. whole stump pasted; branches not removed; etc							

APPENDIX F: CHECKLIST BEFORE HEADING INTO FIELD

Task	Description	Items
Check access and permit for audit area	Contact landowner and identify best approach to access site	• Regional Map • Landowner details
Check direction of transects	Use map and random starting points provided to identify directions of transects and plan approach accordingly	• Random starting points • Audit Map • Overall area cover
Check for difficult terrain and obstructions	Use map to identify difficult terrain and any obstructions along transects that might require modification of the transect	• Map • Direction of transects
Collect field equipment needed	Ensure all equipment is available and in good condition.	• Suitable vehicles - 4x4, LUV and trailer • Vehicle recovery equipment – shovels, winch, tow rope, spare fuel • Plotting equipment • cell phone • tablet • 30m tape or loggers' tape (30m) • Diameter Breast Height (DBH) tape • tags and tie wire (soft aluminium tags– so they can be written on for ID) • height pole • vertex • flagging tape • paint • Sunnto compass/clinometer (x2) • Paper backup maps/forms • Slope sheet • First aid kit, fire extinguisher (for 4x4 and LUV) • Wet weather clothing and emergency shelters (space blankets x 2) • Spare food and water – sufficient for one night out if stuck

APPENDIX G: SPECIES LIST

Scientific name	Common/other Name
Pinus contorta	Lodgepole Pine
Pinus banksiana	Jack Pine
Pinus mugo	Dwarf Mountain Pine
Pinus uncinata	Mountain Pine
Pinus sylvestris	Scots Pine
Pinus pinaster	Maritime Pine
Pinus muricata	Bishop Pine
Pinus nigra	Black Corsican Pine
Pinus ponderosa	Ponderosa Pine
Pinus patula	Mexican Weeping Pine
Pinus radiata	Radiata Pine
Pinus monticola	Western White Pine
Pinus strobus	Eastern White Pine (Weymouth Pine)
Psuedotsuga menziesii	Douglas Fir
Abies alba	Silver Fir
Picea sitchensis	Sitka Spruce
Larix decidua	European Larch
Larix kaempferi	Japanese Larch
Cedrus Deodara	Deodar Cedar

ENVIROMENTAL INCIDENT REPORT CARD

1. Incident Reported by:

2. When did the incident occur? **Day:** **Time:**

3. Where did the incident occur?

4. Type of incident:

- Chemical spill to land,
- Chemical contamination of water,
- Near miss,
- Other? E.g. Cumulative effects i.e. chronic chemical build-up in areas where refuelling often takes place.

5. Cause of incident:

6. The value of any receiving environment:

- Very High (threatened species or ecosystem),
- High (native or productive land),
- Medium (intermixed native or productive species /exotic),
- Low (unproductive exotic).

7. The magnitude (severity) of the incident:

- Severe (affected area >100m², or legacy effect >20 yrs)
- Moderate (area 10m² - 100m², or legacy effect 1-20 yrs).
- Low (area <10 m² or very short temporary effect <1 yr).

8. Using answers to 6 and 7 above, what is the (actual or potential) environmental impact of the incident (circle):

ENVIRONMENTAL IMPACT	VALUE OF RECEIVING ENVIRONMENT			
	LOW	MEDIUM	HIGH	VERY HIGH
LOW	Very low	Minor	Moderate	High
MODERATE	Minor	Moderate	High	Very High
SEVERE	Moderate	High	Very High	Very High

9. Actions taken to remedy the impact of environmental incident:

Contain:

Clean up:

Restore:

Prevent:

10. Any further actions needing to be taken: